

Corrosion News 2020

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our member programs**

**Testbeds for extensive
field- and accelerated testing**

**How accreditation
gives you an advantage**

**Effective research in
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EDITORIAL, SEPTEMBER 2020

Corrosion control for a sustainable future

In 2019's editorial, I talked about how fast our society was developing and at the same time how its vulnerability has increased, thinking mostly about threats of climate change and global warming at that time.

Well, we all have been clearly reminded during 2020 about how fragile our society is. Even if environmental threats have not been in focus the last few months, it is only due to a more acute problem which needs to be solved immediately. However, an increased number of events such as extreme weather, ice melting etc. shows an increased need to act in the very near future. Few things have been business-as-usual during the Covid-19 pandemic, but one exception is corrosion.

For a sustainable society

"Rust never sleeps" is not only a cult rock album from the late seventies, it also literally describes the continuous effect of corrosion, no matter which pandemic, economic or environmental crisis we are going through. Corrosion leads to very large and often unexpected costs, but in addition to the economical aspect, corrosion damage can also imply tremendous environmental hazards and dangers for well-being and life.

Controlling corrosion is necessary to eventually reach a safer, more resilient, circular and sustainable society. In this perspective, it appears more important than ever to work for mitigating the effects of corrosion in our society and economy.

Collaboration needed

Solving the present and future societal and industrial challenges implies the need of a broad collaboration beyond the national, cultural,

economic and technical frontiers. Even in times of travel restrictions and confinement, we need to find new ways to develop our networks, exchange and collaborate. In this issue of Corrosion News, we have chosen to put a special focus on our member programs (MRC – member research consortia), which allow broad collaborative work in specific corrosion sectors. Presently we have 12 MRC's, half led from Sweden and half from France.

We apply knowledge in practice

Another extremely important aspect of our work is to apply our knowledge in practice for testing and approving materials and products, solving issues both within industry and society. In this issue we also present some recent cases related to these aspects. Finally, you will also read about our new organisation, our competences and testing capabilities, as well as current initiatives to be launched during the autumn 2020 and 2021.

I hope you will find this issue of Corrosion News interesting and inspiring. Should you find any article of particular interest, please contact us for more information. If you pass by Stockholm, Brest, Borås or St-Etienne, feel free to contact us, we will be more than happy to show you our facilities and discuss corrosion with you.



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WHAT WE DO

A global partner in the field of corrosion

At RISE, over 100 researchers and experts work with corrosion and how to prevent it. Our mission is to help our partners and customers solve their corrosion issues and minimize damage related to corrosion.

RISE has one of the strongest teams and largest laboratories in the field for applied corrosion research and corrosion protection of materials in the world. More than 100 engineers and technicians in Sweden and France, collaborate extensively with both industry and the scientific community.

Broad expertise

From our four European locations, we can quickly provide solutions to various corrosion problems (including failure analyses, testing, laboratory and field investigations). Our competency in investigations, diagnostics and studies is available for all metallic materials (steel, aluminum, zinc, copper, titanium and various alloys), paints, polymers and composites.

Serving all industries

More than 150 industrial companies all over the world are members of our institute through our different programs. With hundreds of R&D projects and thousands consultancy projects every year, the corrosion department at RISE is involved in most industrial sectors concerned by corrosion. That includes the transportation industry (marine, land, air), building and infrastructure, military and naval construction, oil and gas industry, nuclear and chemical industries, food industry, electronics, et cetera.

Research Institutes of Sweden

RISE is the Swedish Research Institute and innovation partner. In international collaboration with industry, academia and the public sector, we ensure the competitiveness of the business community and contribute to a sustainable society. Our nearly 3000 employees support and promote all manner of innovative processes.

RISE is an independent, state-owned research institute that offers unique expertise and about 100 testbeds and demonstration facilities, instrumental in future-proofing technologies, products and services.



History and location

The RISE corrosion department is located at four sites in Sweden and in France. In addition, we have access to exposure sites all over the world.

We are around 60 people in Sweden, 45 employees in Kista outside Stockholm and 15 employees in Borås in the west of Sweden. We are composed of the corrosion group of former Swerea KIMAB (which arose from the Swedish Corrosion Institute and the Institute for Metal Research) and of the former SP corrosion group.

In France we consist of IC, the French Corrosion Institute, composed of one site in Brest with 25 employees and one site in St-Etienne with 15 employees. IC is a fully owned subsidiary of RISE.

In addition to our four sites, we have exposure sites located at various places around the world, the largest in Bohus Malmö and Kristineberg in Sweden and Brest in France.

We test and verify in different climates and weather conditions, in air, in seawater, concrete and soils and aggressive environments, all over the world.

WHAT WE DO

Expertise and flexibility define our way of working

We believe that being able to offer different ways of working with our customers is essential to deliver valuable applied research and support. We are always happy to discuss your needs to find the optimal services for your business.

Inspections, consultations and analyses

Field or laboratory inspections, failure analysis, expert advice etc. RISE is an impartial and independent partner, and all our consultancies are confidential.



Rapid response problem solving

Quick handling for solving complex problems requiring several different competencies, where we can use the broad competence within RISE.



Accelerated testing

Accelerated laboratory testing of materials, products and coupons in different environments. The tests can be performed according to different standards or specially designed. We can also perform extensive accredited testing.



Field testing and exposure

Exposure and testing of materials and products in natural environments, mainly focused on atmospheric and marine testing. We have different field-testing stations in Sweden, France as well as at our partners worldwide.

Courses, seminars, conferences and training

Standard or customised events related to the field of corrosion and corrosion protection, for example cathodic protection and automotive corrosion.



National and European research programs

Participation with other companies and stakeholders in projects in Sweden, France or the EU. We write applications and manage projects with topics interesting for our customers.



Networks

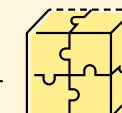
We also manage several networks, regrouping different stakeholders around specific topics areas and challenges, allowing information dissemination and exchanges. Examples of networks are Protection of electronics in challenging environments, Network for materials in contact with drinking water or Corrosion in combustion plants.

Industrial confidential research

We perform confidential research and development projects with our customers, and act as an extra research department.

Member Research Consortia, MRC

Our MRC engage more than 150 companies, large and small, from different sectors, industries, and countries. Joining means increased possibilities, expanded networks and access to the recent updates on knowledge and know-how.



Joint Industrial Programs, JIP

JIP's are a cost effective and efficient way to conduct common industrial projects grouping different actors along the value chain. They are industrially financed programs typically comprising of 8-12 companies, which share the cost of the project. A JIP is usually performed on a 3-year basis.

Find out more on the web

→ ri.se/en/what-we-do/our-areas/corrosion

MRC

12 MRC's in corrosion offering cost-shared R&D

In our Member Research Consortia, MRC, we bring together actors with common interests in specific corrosion areas. We offer a platform for collaboration as well as cost effective R&D. Welcome to join us!

By gathering stakeholders through the value chain with interests in the same research area, we can find efficient solutions to joint challenges. All research projects are initiated in collaboration with our member companies.

Today, our MRC's in corrosion engage more than 150 companies, large and small, from different sectors, industries and countries. Collaboration in any of our MRC's means increased possibilities, expanded networks and access to the recent knowledge and know-how in corrosion. Our twelve MRC's in corrosion are all open to new members.

More information

→ ri.se/en/what-we-do/services/member-research-consortia-corrosion
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Welcome to join our MRC's

In the following pages we present ten of our MRC's, with contact information for each one. You can also read about how some of our member companies describe the benefits of being a member in an MRC.

Two more MRC's on the web

MRC Corrosion Protection

We work with various methods of corrosion protection, such as organic and inorganic coatings, cathodic protection, temporary corrosion protection as well as studying the effects of changes in operating environments.

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MRC Brass Alloys

The research focuses on optimisation of production routes to ensure sufficient producibility and good final properties, mainly corrosion, for lead-free brass alloys, as well as a better understanding of the corrosion mechanisms.

More information

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MRC AEROSPACE

New aerospace materials require defined test procedures

MRC Aerospace is devoted to a better understanding of the corrosion mechanisms of materials used in the aerospace industry. Recently, focus has been to define new testing procedures for qualification of new materials such as Al-Li alloys and surface finishes (free of Chromium 6) for applications in the aerospace industry, including exterior and interior applications and the maintenance aspects.

The MRC has made an important step to better understand the role of different climatic conditions in accelerated corrosion tests on the corrosion of unpainted and painted aluminium alloys. The strategy used in this work includes a design of experiment approach to study the influence of different climatic parameters, such as chloride load, drying phase and high humidity level. And, to compare the results to a worldwide exposure program (performed at a network of field stations within RISE partners).

for different aluminium alloys including 2000 and 7000 series. Both the failure mode and the maximum depth of attacks (not given here) are in good line with that observed at the field station.

Future works are progressing within the MRC to further optimize Test 1 and to standardize this testing procedure within the aerospace industry.

More information

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Broad expertise

The results are thereafter analysed in view of the degradation mode and corrosion depth (for unpainted materials) as well as underfilm corrosion for painted materials. Some results are shown in the figure below. The results clearly indicate that when comparing different accelerated cyclic corrosion tests performed in laboratory with field data obtained at a marine site, a good correlation is obtained for Test 1



ACCELERATED CORROSION TESTS									
Alloy	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8	Field
2024T351	IG	IG	IG	IG	IG	IG	IG + E	IG	IG
7075T6	IG	IG	IG+E	IG	IG	IG	IG+E	IG	IG
7449T651	P	P	IG+E	E	P	P	P+E	E	P
7050T7451	P	P	P	P	P	P	P	P	P
7055T7751	P+IG	P	P	P	P	P	P	P	IG
2099T86	P	P	P	P	P	P	P	P	P
2050T3	IG	P+IG	P	IG	IG	P	P+IG	E	IG
2050T8	P	P	P	P	P	P	P	P	P

Summary of the type of attacks (P: pitting, IG: intergranular corrosion, E: exfoliation) for different alloys in cyclic corrosion test and 18 months at a field station in Brest, France.

MRC AUTOMOTIVE CORROSION

Solutions for greater sustainability in the automotive industry

With 35 international member companies, MRC Automotive Corrosion, is our largest membership program within the field of corrosion. The MRC provides a unique combination of practical knowledge and scientific excellence concerning corrosion and corrosion protection of vehicles. The customer focus, is one of the most important aspects for the members of the MRC.

Within MRC Automotive Corrosion, vehicle manufacturers, material suppliers and paint/pretreatment suppliers meet and discuss common issues.

Elizabeth Szala, Project Manager R&D at Aleris, has been a member of the MRC since she graduated from university and started to work in the steel manufacturing industry.

– I discovered that the MRC Automotive Corrosion was a great platform to exchange knowledge in automotive corrosion and meet people from the different sectors supplying products for our market. Moreover, not only European

researchers and engineers are participating in the working group, also companies in the US as well as Asia. When I changed jobs and companies, I always carried on being part of the MRC to remain up-to-date with the new research, says Elizabeth Szala.

In addition, Elizabeth Szala is a member of the Scientific committee of the European Federation of Corrosion where she is responsible of automotive corrosion and acts as coordinator of automotive corrosion activities at the European level.

Analyse various materials

The focus of MRC Automotive Corrosion is to study and analyse corrosion of various types of materials to improve and develop solutions that lead to greater sustainability and competitiveness in the automotive industry. The members meet twice a year to discuss the progress of the projects.

Some projects are longer-term with automotive corrosion monitoring in field for instance and some can be short-term answering very specific and precise questions such as the road salt usage and composition over recent years or testing different materials under a specific condition.

– One of the key aspects of the MRC is the fact that it is customer-driven, the customer is being listened to and this is highly appreciated. The people leading the MRC have extensive knowledge in the field and great experience and that's a true added value for our industry, says Elizabeth Szala.



The members decide which projects to start

The members of MRC Automotive Corrosion meet twice a year to discuss new projects as well as the progress and results from ongoing projects. Here are our ongoing projects:

- Evaluation of corrosion from intentionally made scribes on painted corrosion test specimens
- Standardised bimetallic- and crevice corrosion test specimens for the automotive industry (see below)
- Adhesive bonding of aluminum parts in the automotive industry, part II
- Survey of the use of de-icing salt in road environment
- Filiform corrosion of Aluminium
- Long term on-vehicle exposure of different types of automotive materials
- The influence of different de-icing materials on corrosion of automotive materials
- Development of an accelerated corrosion test that better mimics field conditions

Standardised bimetallic- and crevice corrosion test specimens

The eventual corrosion observed on the car body are most often situated in hem flanges and

spot-welded joints. To perform corrosion tests of these types of confined environments are much more difficult compared with open surfaces due to:

- perforation/bimetallic corrosion is more complex and thus more difficult to simulate
- it is often difficult to compare the results obtained in different corrosion tests using the different types of crevice/bimetallic coupons due to poor reproducibility of the specimens
- the design of the crevice/bimetallic specimens is very much influencing the results.

Therefore, standardised corrosion test specimens for crevice- and bimetallic corrosion is eligible.

The aim of this project is to find crevice corrosion and bimetallic corrosion specimens for the automotive industry with good repeatability of corrosion attack that can be used at accelerated corrosion tests and in mobile corrosion tests.

The results of the project will be available to all members of MRC Automotive Corrosion.

More information

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Experimental R&D for H₂S related corrosion

Thanks to the R&D programs within the MRC Oil and Gas its 13 members receive the latest research and knowledge in the field of corrosion in the oil and gas industry. For example, results from experimental programs addressing H₂S related corrosion issues.

In the MRC Oil and Gas, two projects are always ongoing, one focusing on stainless steels and the other on carbon steels. The aim of these projects can be to develop a new test method, to make a literature survey on a dedicated topic or to evaluate the material acceptability in harsh environments. These projects are selected by the members, often after a proposal of a participant or of RISE.

Projects to determine the criticality

The projects currently in progress within the MRC are:

- Criticality of groove formation on unfailed carbon steel specimens after sulfide stress cracking (SSC) tests: the project aims at evaluating if the micro-grooves (see photograph) sometimes observed on non-broken



Example of grooves formed on a low-alloyed carbon steel after SSC test.

specimens after SSC tests must be considered as crack initiation and thus as critical.

- Criticality of selective dissolution during SCC test of duplex stainless steels in H₂S containing media: when duplex stainless steels are tested in borderline conditions superficial selective corrosion (see photograph) can be observed on the specimen after test without associated crack initiation. The objective of the work is to define if such patterns are critical.

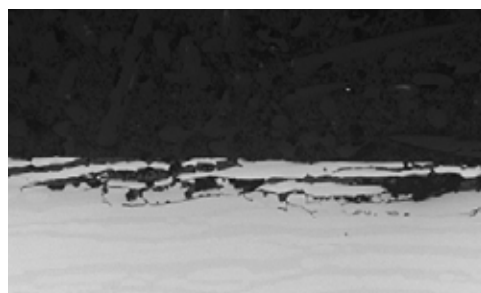
Some recent projects focussed on test method comparison for H₂S testing, on developing a test method to measure critical pitting temperature in H₂S containing environment and a literature review on the detrimental effect of elemental sulfur in the oil and gas industry.

When agreed by the members, the results are published. For example Corrosion Science 142 (2018, p. 56) can be cited. The ongoing work on carbon steel will be published or presented at a conference.

More information

→ ri.se/en/mrc-oil-and-gas

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Example of superficial selective dissolution observed on a Duplex stainless steel 2507 after SSC test.



“Opportunity to meet with other industry partners”

Total is a major oil and gas company, a global, integrated company with exploration and production as well as refining and petrochemical activities. Total has also become a significant actor in renewable energy with activities in solar energy, energy storage, biogas and wind power. For Total, MRC Oil and Gas is important in several ways.

Thierry Cassagne PhD, Corrosion and metallurgy expert at Total explains why Total has been a member of the MRC Oil and Gas since the start.

– The MRC is important for Total because it can provide new insights and data concerning the use of metallic materials in H₂S containing environments. As in all research fields it is essential to always increase our knowledge to then apply it for projects and support to operations where it is needed.

Total is today following several projects within the MRC and they are satisfied with the good progress of the studies.

– Collaborating with RISE is quite important for us because this organization provides skilled people, the ability to understand our needs and the means to carry out corrosion studies with efficiency. Another important positive aspect is the opportunity to meet with other industry partners to have stimulating discussions and share our views on these important corrosion topics, says Thierry Cassagne.



Thierry Cassagne, Total

New knowledge on weak links in polymers

For more than 30 years, research on corrosion properties of polymers in harsh chemical conditions have been conducted at RISE as well as in the MRC Corrosion Properties of Polymers, CPP. The aim of the MRC is to help the members to find the right polymeric material solution for their business.

Today the MRC Corrosion Properties of Polymers, CPP, has more than 25 members, most of them international companies. The members are end users within the chemical industry, such as pulp and paper plants, chlorine plants as well as producers of polymeric pipes and pipe parts.

The members have a common interest in finding the right polymeric material solution for their business needs. Even though great steps in knowledge have been taken when it comes to

predicting the expected service life and expected rate of corrosion the need for new research to match with the ever-ongoing development of new materials is large.

Investigating welds

Welds tend to be the weak link in the use of plastics. In an ongoing project within the MRC CPP different PVC-grades and fluoroplastic welded with different techniques are evaluated

according to their ability to withstand highly concentrated (98 wt. percent) sulfuric acid at 50 degrees Celcius. The samples will be assessed after exposures of up to 48 weeks.

The result of this project will give the members of MRC CPP a deeper knowledge on the materials suitability to highly concentrated

sulfuric acid and critical welding parameters that should be considered when used under real service conditions.

More information

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“The MRC is an important resource to improve the understanding of corrosion mechanisms”

Regular personal networking with other corrosion experts, all along the supply chain and learning about new trends and technologies. These are some of the reasons why the company Georg Fischer DEKA GmbH chooses to be one of the members of MRC Corrosion Properties of Polymers.

Stephan Schuessler, head of R&D at Georg Fischer DEKA GmbH, tells why the company has been a member in MRC Corrosion Properties of Polymers since 1996.

– For us the MRC is important for several reasons. It gives us the possibility to network with new members and potential new clients. We can learn about and have discussions concerning new trends, technologies and fields of application. The MRC is also an important source to improve the understanding of fundamental corrosion mechanisms, this in turn serves as a further input for our own material and formulation development, Stephan Schuessler says.

Georg Fisher DEKA GmbH was founded in 1960 and focuses solely on industrial piping as the core business. The product portfolio comprises a worldwide unique selection of different thermoplastic polymer pipes as well as well-developed facilities for fabrication of customized products. The company has been part of several successful projects within the MRC.

– Over the past 25 years we have had a very positive and interesting cooperation. Along with some other MRC members, we have recently decided to launch a new project together with RISE on assessing the influence of next-generation thermo-stabilizers in Vinyl-polymers on the chemical resistance-properties. Such topics are very relevant for the application of these products and for the majority of members of the group, but way too large to be handled by one company alone, Stephan Schuessler says.



Stephan Schuessler,
Georg Fischer DEKA

Focus on pickling processes

In the network Plastics for Pickling Committee, PPC, we have a special focus on pickling processes. Plastic materials are frequently used in process equipment for pickling in steelworks. The purpose of the PPC network is to increase the knowledge of how plastic materials in process equipment are affected by acids such as nitric-, hydrofluoric-, hydrochloric- and sulphuric acid.

More information

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Better understanding of soils increases infrastructure safety

Buried structures are usually protected against corrosion with the use of metallic coatings or a combination of organic coatings and cathodic protection. Better understanding of corrosion ensures infrastructure safety and integrity with time. The MRC Soil Corrosion gives its members a better understanding of the effects of soil.

Soils are complex, with various textures, oxygen diffusion and resistivity as function of the water content and are subjected to seasonal fluctuations. This MRC started in 2018, is dedicated to soil corrosion and cathodic protection (CP). Today twelve member companies, from the oil and gas industry as well as coating producers, take advantage of cost-shared R&D programs selected by themselves.

Four running R&D programs

Among the running R&D programs, two are focusing on cathodic disbondment (CD) rate of industrial coatings such as Fusion Bonded Epoxy (FBE) and 3 Layer Polyethylene (3 LPE). The objectives are to:

- Assess the over-protection risk in soil as a function of the potential, the soil texture and water content
- Determine the key parameters driving the CD rate
- Determine the CD rate evolution with time

A third program is dedicated to the determination of the time and kinetics of corrosion after CP interruption in soils. For this purpose, an innovative approach is proposed using electrical resistance sensors, oxygen and pH probes. Indeed, the local alkalinity induced by the CP might favor passivating conditions of steel. Thus, after CP interruption, a delay of even several days can be observed before the occurrence of corrosion.

A final program focusses in comparative soil corrosion tests using similar natural soils in laboratory and field. The materials tested consist of carbon steel, Zn and ZnAlMg hot dip galvanized steel. The objectives are to collect corrosion data on recent materials and to better understand the key parameters driving the corrosion kinetics in soils.

More information

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Solves upcoming challenges in the pulp and paper industry

Pulp and paper mills are exposed to extreme conditions and corrosive environments, which can cause downtime and high renovation costs. At the same time new demands on materials are constantly being made. As a member of MRC Corrosion in the pulp and paper industry, CPPI, you can expand your company's corrosion expertise in a cost-effective way.

The pulp and paper industry is facing new demands on recycling, energy savings and reduced water consumption that can lead to changed operating conditions in the mills, which can cause increased corrosion problems. In addition, processes to manufacture new biobased products can create unexpected corrosion problems.

At RISE, we have broad and deep knowledge of corrosion of both polymeric and metallic materials, and our research linked to corrosion in the pulp and paper industry has a long tradition. Within MRC Corrosion in the pulp and paper industry, CPPI, the members exchange experiences and discuss what research the industry needs. Here are two examples of issues recently investigated.

From sulfuric acid to hydrochloric acid?

In connection with the bleaching process of a pulp mill sulfuric acid is used. A mill is considering replacing sulfuric acid with hydrochloric acid in the bleaching process. They want to find out how well the materials would perform in contact with hydrochloric acid. Both acids were sent to RISE, and the materials used in the process piping were exposed for 60-70 days. The results showed that

hydrochloric acid is not more corrosive to the present materials than the sulfuric acid.

What is the best material for evaporators?

Another investigation within the MRC showed how different materials coped with the environment of evaporators. A field exposure was conducted, with eight different sample materials fixed to a test rack, welded to the evaporator at three mills. After one operating season the samples were examined for mass loss and general surface attack.

Among other things, it was found that the molybdenum content is to some disadvantageous, depending on the high pH value in the evaporators, especially for the stainless steel 1.4401, although the molybdenum content is generally considered to give a stainless steel a higher corrosion resistance. In addition, it was found that the five duplex materials were equivalent in the current environment, although some varied in quality from "Lean Duplex" to "Super Duplex".

More information

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Courtesy of SSAB; Tin House (London);
Photo: Tim Soar & Luke Cauldfield;
Drawings by Eliana Sousa; Henning
Stummel architects.

MRC COIL COATED MATERIALS

R&D projects for tomorrow's prepainted metal

Prepainted metal is popular in a wide range of applications, such as buildings, domestic appliances and in the transport industry. The producers are continually innovating to meet new demands from the market. MRC Coil Coated Materials assists its members with the latest knowledge on the corrosion properties of prepainted materials.

Prepainted materials are produced by coil coating process. In the building industry, which represents about 75 percent of the market, prepainted products offer many advantages for facades and roofing due to their design flexibility, the large variety of textures and colours and possible added functionality.

The producers of prepainted metal, the suppliers of the metal substrate and of the organic coatings are continually innovating to meet the

needs of the market and to satisfy the customers. The corrosion properties of prepainted materials are of high importance for the durability of materials.

MRC with worldwide members

The MRC Coil Coated Materials started in the 90s after a request from Swedish Steel (SSAB Europe) and Usinor (ArcelorMittal). Today the MRC has worldwide members including major steel makers, chemical and paint companies and offers a unique forum of exchange, that has resulted in many R&D projects in corrosion and corrosion protection.

Ongoing R&D programs

- Database of corrosion behavior of a large number of coil coated steel products in laboratory tests that will help modeling the data with respect to environmental parameters

- Long term degradation of coil-coated steel materials as a function of the distance to the seashore in temperate climate
- Durability of prepainted steel materials in agricultural buildings
- Development of reliable accelerated corrosion tests for coil coated steel products
- Evaluation of chrome-free pretreatment alternatives for prepainted zinc and zinc-alloy coated steel
- Better understanding of the blistering formation on prepainted steel materials
- Effect of water disbondment on adhesion properties and coil-coating performance
- Testing the durability of repair solutions for prepainted steel materials

The MRC also organizes international seminars dedicated to coil coated steel products.

Upcoming challenges for the industry

The industry's major challenge is to meet the expectations of the end-users of the finished product with as low as possible costs and effort. This means reducing the zinc layer while keeping or increasing the performance of the products. This would need new (quick and cost efficient) laboratory test protocols with better correlation to field exposure to support more rapid development of new products and associated product warranties.

Also, to facilitate the development of new products is of utmost interest, to develop physical prediction models of the degradation of prepainted steel at any global site.

More information

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"A win-win situation for all involved partners"

Voestalpine Stahl GmbH is a global manufacturer of high-quality steel products with headquarters in Austria. They rank among the leading suppliers to the European automotive, domestic appliance and construction industries, as well as to steel construction and engineering businesses.

Main benefits

Since 2008, voestalpine Stahl has been a member of the MRC Coil Coated Materials. Bernhard Strauß, senior engineer at voestalpine Stahl and Chairman of the MRC Coil explains why:

- The main benefit is to share competences and to share costs in order to achieve high quality results with limited individual resources. I am convinced that non-competitive joint research offers a typical win-win situation for all involved partners, he says.



Bernhard Strauß,
voestalpine Stahl and
Chairman of MRC Coil
Coated Materials

The R&D projects in MRC Coil Coated Materials are focused on the one hand on optimizing the steel production process in regard to quality, environment and energy efficiency, and on the other hand on the development of high and highest strength steels as well as on the development of new coatings.

– We are, like every partner, involved in all MRC-projects and over the years in a few joint industrial projects. My personal favorite is the "Coil Database" project where all coil coaters have contributed with a notable amount of their commercial materials – all together 13 different coating systems, says Bernhard Strauß.

Study of low grade alloys in O₂ controlled seawater

Seawater is known to be an aggressive media which limits the use of most materials due to corrosion issues. In the MRC Marine Corrosion, we study and analyse the limits for materials and corrosion protection in seawater.

During the bi-annual meetings, the members of MRC Marine Corrosion decide what issues to investigate. Right now, the MRC is looking into the issue of using low grade alloys in treated seawater, when oxygen is partly removed. This can be the case in injection wells, flexible storage in seawater and/or desalination plants.

From this industrial need a new program was initiated to investigate the behaviour of several “low” stainless steel grades (duplex, austenitic, martensitic) in term of localized corrosion risk in O₂ controlled seawater. The objective was to determine the critical dissolved oxygen content at which crevice corrosion can initiate.

In the last decade RISE developed a unique experience in precision control of dissolved oxygen content of continuously renewed natural

seawater. The innovating test loop is then maintaining the biological activity of natural seawater, which is one of the key parameters to simulate service conditions. The proposed corrosion test is then not only used for ranking purposes but for a precise definition of a materials limit of use in simulated field conditions.

Decreased costs

The continuous monitoring of corrosion potentials and environmental parameters allows determination of the incubation time before corrosion eventually starts (if any) and parameters that can favour re-passivation. By selecting lower grade alloys, the cost of projects can then be significantly decreased, keeping confidence in the corrosion resistance from the representative engineering diagrams. Thus, these diagrams define the limit of dissolved oxygen at which the alloy can be safely used for a given application.

More information

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Example of corrosion diagram of one of the tested alloys:
Potential versus Oxygen content with associated corrosion risk.



New MRC will help biorefineries with their corrosion challenges

During 2021 RISE will start a new MRC in order to develop and provide suitable testing for corrosion evaluation of materials in biorefinery production. Based on scientific research, as well as collaboration among researchers, scientists, material manufacturers and biorefinery plant operators, the new MRC will help its members with important corrosion challenges.

Biorefinery production in EU has been a focus the past few years and the industry is continuously growing. In 2017, there were 224 biorefinery plants operating across Europe. By the end of 2030, the aim is that at least 14 percent of transport fuel will come from renewable resources.

A young industry with its own challenges

Biofuels are produced through biorefinery processes involving four different feedstock generations. The evolution of feedstocks aims to overcome previous limitations, for example resources of harvesting, process technologies and energy yields.

Due to different types of raw materials and final products, biofuels are produced through different conversion processes, which operate at different temperatures and pressures and involve a wide range of chemicals, catalysts and enzymes.

Because of the “young-age” of biorefinery plants in Europe, corrosion-related failure cases are not yet numerous. However, preventive maintenance by means of material selection is crucial to avoid corrosion challenges like those experienced in conventional refineries.

Develop test methods

During 2021 RISE will start a new MRC on application of stainless materials in biorefinery processes. The aim for the new MRC is to develop and provide suitable testing for corrosion evaluation of such materials in different service conditions in biorefinery production.

Expertise among members in the MRC can be exchanged to facilitate a development of testing and research activities concerning corrosion of stainless materials in biorefinery processes.

Furthermore, the MRC will be a valuable complement to the extensive and ongoing research work within RISE on new and advanced biorefinery processes.

Contact

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MRC SURFACE TECHNOLOGY

Advanced analytical methods help develop better surface protection

Corrosion protection of metal surfaces normally requires the application of multi-layer coatings, which can be a challenge to characterize. MRC Surface Technology offers customers the tools and knowledge to understand and develop coating systems and pretreatments using advanced analytical methods.

MRC Surface Technology focuses on studying surfaces and multi-layer systems with advanced techniques. By gathering different companies in the industrial sector, we can find efficient solutions to joint challenges. We work with various materials, such as steel and other metals, organic and inorganic coatings and composites.

Multi-analytical approach

Analyzing surfaces and multi-layer systems is a challenge and many different characteristics are important including thickness, composition structure, adhesion, gloss, hardness, barrier properties and corrosion performance. It is not possible for a single technique/method to collect all this information and therefore a

multi-analytical approach is needed. This could be spectroscopic methods, electrochemical methods and other methods ex situ as well as in situ or in the form of sensors.

Synchrotron-based nano-IR

Several studies proposed by the members are ongoing with specific focus on advanced analytical techniques. Right now, we are increasing our knowledge in the area of nano-IR spectroscopy and imaging, based on synchrotron radiation (SR). The project aim is to investigate the possibility to use nano-IR and related techniques for studies of the degradation chemistry of sustainable organic coatings, by performing a preparatory study.

During this project we have been in contact with experts at European synchrotron facilities. Our intentions are to use the Metrology Light source in Berlin, which is dedicated to e.g. infrared nanospectroscopy (nano-FTIR) in the range of mid-IR. The project is funded by the Swedish Research Council, Vinnova.

More information

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Dan Persson, RISE

AWARDS

Einar Mattsson Award 2019

Dan Persson, researcher at RISE, has received the 2019 Einar Mattsson Award. Dan Persson has contributed to a strong development in the area of surface engineering and surface analysis, through technical and scientific excellence, sustainable work and ingenious innovations.

Dan Persson is a highly appreciated partner by our customers. His solid experience, both scientifically and industrially, combined with his humble attitude makes him a constant source of knowledge and inspiration for colleagues in his surroundings.

NEW EQUIPMENT

Investment in a nano-IR instrument

The area of surface protection and degradation is undergoing great changes. For example, the development of organic coatings with bio-based components and surface treatment processes with lower energy consumption. In electrification of vehicles degradation and corrosion of materials in batteries and fuel cells are of importance.

PHD RESEARCH PROJECT

Predicts the performance of next-generation coatings

A common way to prevent corrosion is to cover metal surfaces with complex organic coating and paint systems. The main goals of Alexander Wårnheim's PhD project are to gain a deeper understanding of the degradation processes that occur in these systems and to connect local chemical and mechanical changes with the performance of the coating over time.

This knowledge will be used to predict the performance of coming generations of coatings without the need for multi-year field trials for each individual formulation.

– I choose to do a PhD at RISE for the possibility to work with both industry and academia to solve problems with close-at-hand applications.

To support these developments, RISE has invested in a new Nano-IR instrument, partly supported by Hugo Carlsson fund. The new equipment is based on a combination of IR spectroscopy and atomic force microscopy (AFM), providing information on chemical bonds and functional groups (affected by degradation) with a resolution at nanometric level. The new instrument will be a complement to our FTIR-imaging and improve our possibilities to study interfaces in surface coating systems, new pre-treatment systems for coil-coated products, as well as local corrosion processes.

More information

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Alexander Wårnheim, RISE

I have been able to work with talented people from a variety of backgrounds and competences and I have collaborated with researchers specializing in everything from microfabrication to nanocellulose, says Alexander Wårnheim.

More information

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TESTBEDS

Testbeds for innovation, testing and verification

In the area of corrosion, RISE offer a combination of field testing, accelerated testing and modelling. Field testing is especially important in corrosion, as the correlation between real conditions and accelerated testing is often difficult to assess. We can offer tests and verification in different climates and weather conditions, in air, seawater, soils and aggressive environments, all over the world.

The ability to test and evaluate ideas at an early stage increases the pace of innovation, reduces risks and streamlines product, process and method development. The advantages of utilising a test and development environment are many, although the most important are reduced development costs and shorter lead times between concept and marketing. RISE has approximately 100 testbeds, and they all offer:

- Equipment adapted to industrial uses
- Qualified operators and technicians

- Expert competence
- Supplemental testing and analysis
- National and international networks
- Forums for the exchange of expertise and business development
- Training and skills development
- Funding opportunities

More information

→ ri.se/en/our-offer

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Atmospheric corrosion testing

Corrosion testing under field conditions is necessary to obtain real and relevant data on material life and degradation in different environments. For atmospheric corrosion, this is accomplished by exposing metal coupons or industrial products in real-world environments for a specified period and then evaluating the corrosion using standardised methods.

Within the testbed, there are several stations in different environments, such as marine, rural and subarctic atmospheres. The data obtained can also be used to verify the results of accelerated corrosion tests in corrosion chambers.

The field tests are used to test products in, for example, the automotive and building industries and infrastructure, but also to meet society's need to know how corrosion changes over time



and is affected by climate and the environment. Our test environments:

- Bohus Malmön, Sweden (marine atmosphere)
- Brest, France (marine atmosphere)
- Ryda Kungsgård, Sweden (rural atmosphere)
- Gällivare, Sweden (subarctic atmosphere)
- Dubai, United Arab Emirates (UV- sand abrasion atmosphere)
- Malaysia (tropical environment)

Testing in climate chambers is used to compare the corrosion resistance of different materials and material combinations in a variety of atmospheric environments. We offer a wide range of options for testing. Our climate chambers are equipped to enable the environmental conditions to be varied during exposure in a controlled manner.

The main parameters that are varied are temperature, humidity, salt content, UV light and the presence of corrosive gases. We have climate chambers for temperature and humidity cycling, corrosive gas testing combined climate and salt spray chambers, climate chamber testing with simultaneous mechanical fatigue testing. Our laboratory in Borås in Sweden also offers accredited corrosion testing.

→ ri.se/en/test-demo/atmospheric-corrosion-testing

→ ri.se/en/what-we-do/services/weather-durability-test

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Weathering testing

At our laboratory in Borås we offer accredited weathering testing on surfaces utilizing state of the art equipment with both control of UV spectrum as well as temperature and humidity. Here we have the possibility to expose entire assemblies and 3D objects and our lab utilizes both fluorescent and xenon lamps. We offer both standardised testing as well as custom fit exposures and measurement of colour, gloss and coating deterioration.

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Mobile corrosion testing

During mobile corrosion testing, materials, designs or different types of corrosion protection for the automotive industry are investigated in a real road environment. We offer exposure on the under body of truck trailers in one of the world's most corrosive environments. The results of the mobile test are then evaluated using standardized methods.

→ ri.se/en/test-demo/mobile-corrosion-testing

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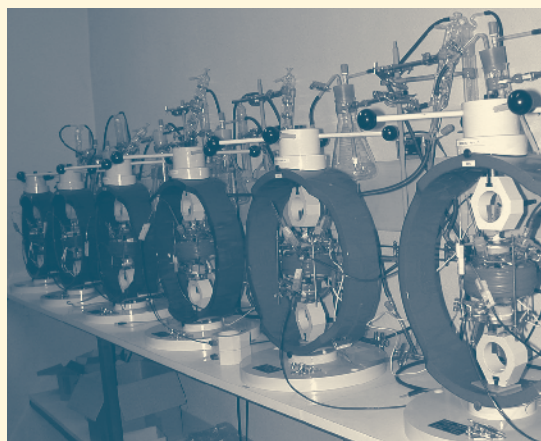
TESTBEDS



Tests in H₂S environments

Standard cracking tests in H₂S containing environments can be performed at our testbed (for example according to NACE TM0177, NACE TM0284, NACE TM0316, NACE TM0198) under high pressure of CO₂ and/or H₂S and at elevated temperature. We can also perform cracking tests, slow strain rate tensile test, high pressure and high temperature tests in autoclaves, corrosion fatigue tests, tests in explosive environments, and hydrogen permeation tests and electrochemical tests under pressure.

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Corrosion tests in soil

The need for new buried infrastructure is increasing. Using the testbed, you can evaluate material durability and the need for corrosion protection and maintenance for pylons, sheet pilings, water and gas pipes that are subject to corrosion in the soil. We offer real-world testing, in five locations with different soil conditions.

The testbed gives you access to RISE equipment and our combined expertise. The testbed will give your company answers to questions related to:

- How different materials corrode in soil
- The functionality of different organic and inorganic coatings
- The effect of different back-fills

→ ri.se/en/test-demo/corrosion-soil

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High temperature testing

At our testbed we can perform high temperature corrosion tests in the aggressive gases such as CO, H₂S, SO₂, Cl₂ and HCl. We address corrosion problems in combustion environments, e.g. biomass or waste-fueled CHP plants, aircraft engines, gas turbines, as well as in heat-treatment applications and in refineries.

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Testing in natural sea water

Tests in natural seawater can be performed at our field laboratories in Brest, France and Kristineberg, Sweden, as well as on other partner sites around the world.

Read more about our services in natural sea water testing on page 28.

→ ri.se/en/test-demo/materials-marine-environment

→ ri.se/en/test-demo/corrosion-testing-natural-sea-water

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Rigs for drinking- and wastewater

In our testbed we can run simulation of operating conditions for materials in contact with drinking and waste waters. The development of materials for water applications has gained attention recent, due to new regulations and longer lifetime requirements. Being able to test materials and products with different types of water and under different conditions is essential to support this development.

RISE testbed includes rigs for testing different types of pipe materials and components with water as well as a chlorine rig to test material in pipes and applications exposed to chlorine or chlorine dioxide. This testbed is used to perform assessment and gain experience within:

- Understanding material degradation, biofilm formation and leaching for different waters (varying parameters, such as pH, flow rate, alkalinity and chlorine content)
- Performing comparative testing for different types of materials (copper and alloys, stainless steel, coated carbon steel, polymers)
- Performing corrosion tests including biofilm formation and leaching properties, according to real operation conditions (water composition, flow rate, etc.) uniformly for all types of materials (metals and plastics)
- Testing the effect of water disinfection using chlorine on the corrosion rate in pipes and other details

→ ri.se/en/test-demo/chlorine-rig

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100 testbeds within RISE

RISE has approximately 100 testbeds and demonstration environments are open to businesses, academia and the public sector.

More information

→ ri.se/en/testbeds

TESTBED

Two seawater stations that give unique possibilities

Artificial seawater is not always adapted for corrosion assessment of materials, since complex parameters involved in corrosion processes can be difficult to reproduce. This includes the natural biofilm formation connected to bacterial activity. RISE test beds in marine environment helps customers within marine energies, the shipping industry and the oil and gas industry.

RISE has developed a unique framework of seawater stations for corrosion, biofilm and antifouling studies. It can be adapted for the testing of any kind of seawater system, from small to large scale, with accurate control of test parameters.

RISE is operating two main stations in Europe, one in the bay of Brest, France, which is representative of standard Atlantic Ocean conditions with temperate seawater, and one in Kristineberg, on the west coast of Sweden, in the North Sea.

Here we have the possibility to expose materials in the open sea at different exposure depths from 0 to 35 meters. In addition, the seawater stations are equipped with exposure cells and tanks where the flow rate, the temperature, the dissolved oxygen content and seawater treatment (chlorination) can be controlled. Bespoke seawater loops are built for full scale testing. Corrosion monitoring can also be implemented on site, with potential loggers, cathodic protection and biofilm sensors, etc.

At both locations we have well-equipped corrosion labs with cyclic corrosion chambers, alternate immersion rigs, and equipment for electrochemical measurements. Jetties with

easy access from the lab facilities, can be used for different purposes such as tests in different zones, submerged, splash zone or atmospheric.

Our customers in the field of marine energies, shipping industry, oil and gas, are all concerned by offshore corrosion. Collaboration with laboratories allows exposure in other types of seawater such as in tropical seawater (Malaysia), or in deepsea water from 1000 to 3000 meter depths.

More information

→ ri.se/en/test-demo/materials-marine-environment

→ ri.se/en/test-demo/corrosion-testing-natural-sea-water

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RISE Kristineberg, Sweden

EXPERT CONSULTANCY

Bresle test shows low salt levels on the golden bridge

Central Stockholm is getting a facelift with the new Slussen area. In the middle shines a golden bridge, 140 meters long and 45 meters wide. Skanska partnered with RISE to inspect the salt content on the surface of the bridge, to avoid future risk of corrosion.

– It is an extraordinary building project, says RISE researcher Alexi Makdesy who got a close look at the new golden bridge in central Stockholm.

The steel bridge is designed by UK-based architect Foster + Partners. The arrow-shaped silhouette comes from the level differences between the islands Södermalm and Old Town. The bridge was manufactured by CRSBG in China and was delivered, in one piece, by boat, to Stockholm in March 2020.

Before blasting and final painting in gold colour, the constructor Skanska wanted to measure the chloride content on the surface of the road's isolation material. The levels of salt cannot be too high, otherwise there is a risk that these salts are blasted into the steel, which can lead to a corrosion risk.

– There was a suspicion that the chloride content would be elevated, as the bridge travelled across the sea from China. Prior to testing, the entire surface was rinsed off, thoroughly, with water to remove salts. The test was performed to ensure that the salts had disappeared, explains Mattias Nääs at Skanska.

Alexi Makdesy from RISE conducted the salt test inspection in three locations of the bridge, using the Bresle test method.

– We checked the salt contamination and found that the percentage was very low and that it was safe to continue with the blasting, says Alexi Makdesy.

Later, the bridge could get its final layer of golden paint. The colour is chosen to harmonize with the golden yellow shades of the houses in the



The golden bridge, during construction in 2020.

Old Town, and the sparkling reflection from the water. In Autumn 2020 the bridge will be ready for traffic.

More information

→ ri.se/en/what-we-do/services/bresle-on-site-testing

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Bresle tests and test kits

RISE offers the service of testing according to the Bresle method. We also offer the patches and testing kits for Bresle tests. The patches are manufactured for RISE and are available in small and large quantities. The Bresle kits consist of everything needed for conducting a measurement.

PHD RESEARCH PROJECT

New coating acts as catalyst in batteries

The objective of Clara Linder's PhD research project is to develop novel high-performance physical vapor deposited (PVD) multicomponent CrFeNi-based coatings, that are both highly corrosion-resistant and electrochemically active towards reduction of O₂ for applications in industrial batteries with water based electrolyte and fuel cells.

The project Corrosion-resistant and catalytically active multicomponent coatings for batteries and fuel cells, is a collaboration between RISE, Linköping University (LiU) and Swerim, within the Vinnova Competence Centre FunMat-II, and part of a PhD research program (2019-2024). The aim is to understand corrosion resistance and electrochemical activity in multicomponent

alloys with catalytically active elements (Co and Mn) incorporated to them. In the last part of the project, the coatings will be tested in battery- and fuel cell environments.

- This will provide a long-term contribution to a renewable, environmentally friendly and robust energy system and to Swedish industry and academic research, says Clara Linder, researcher at RISE.

Decreased need of maintenance

Industrial batteries are crucial for energy back-up in hospitals, industry, and cities. Reactions in a battery cell ensure a full charge, but also creates byproducts: H₂ and O₂. The drawback is that it consumes water from the electrolyte and implies a need for costly maintenance. A solution is the recombination of H₂ and O₂ to form water. To increase the reaction rate, a catalyst is introduced. The harsh conditions in the battery and lifetime expectancy place high requirements on long-term stability, stressing a need for corrosion-resistant coatings that can act as a catalyst.

CrFeNi based coatings are deposited with a magnetron sputtering PVD system at LiU (Linköping, Sweden). After detailed material characterisation of the coatings, their corrosion resistance and the catalytic activity are tested with electrochemical methods at RISE (Kista, Sweden). So far in the project, pure Co coatings have been electrochemically modified and demonstrated as effective catalysts for the reduction of O₂ in KOH. The corrosion resistance of different CoCrFeNi coatings has been studied in NaCl and KOH.

More information

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Clara Linder, RISE



Pierre Bonin

PHD RESEARCH PROJECT

Understanding the mechanisms of blistering on coil coated materials

The tendency of a paint system to blistering depends on many parameters, including bulk properties of the polymer and interactions at the metal/polymer interface. Wet adhesion is one of the most important properties affecting the corrosion protection performance of organic coatings.

Comparing the behaviour

Influence of interfacial bonding properties can be easily verified by comparing the behaviour of the same paint systems applied on different substrates or after different surface pre-treatments.

The interface between a metal substrate and polymer coating is thermodynamically unstable in the presence of water. Indeed, the binding energy of secondary metal-adhesive bonds is lower than that of metal-water bonds. Thus, the presence of water at the metal/coating interface

should lead to interfacial bonding deterioration and then to macroscopic blistering.

In 2018, we initiated a PhD in collaboration with CIRIMAT (Interuniversity Center of Materials Research and Engineering in Toulouse, France). Pierre Bonin was recruited to RISE as a PhD student in September 2018. His work is focused on the understanding of the mechanisms of blistering on model coil coated materials. For this purpose, different laboratory techniques such as Electrochemical Impedance Spectroscopy and scanning Kelvin probe are used. Pierre will defend his PhD work in September 2021.

More information

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PHD RESEARCH PROJECT

Initiation of corrosion of steel in concrete

Research has been ongoing for decades regarding the initiation of corrosion of steel in concrete, mostly focusing on how to determine a critical chloride concentration which initiates corrosion.

- This critical chloride concentration is important for authorities that maintain infrastructure because they want to have a value which indicates if their critical assets such as bridges for example are corroding or not. Previous research has resulted in a wide range of critical concentrations and we know that it is very difficult to determine this value. This means that we need to understand more about the corrosion initiation process, explains Johan Ahlström, Researcher at RISE.

After his licentiate project, Johan Ahlström focused on how the mill scale on the steel surface can influence the corrosion initiation.

- My conclusions so far are that the mill scale is nobler than steel and its composition affects the galvanic corrosion of the steel, says Johan Ahlström.

More information

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Why accreditation gives you an advantage

At the RISE product durability laboratory in Borås, Sweden we offer a wide variety of testing services. These tests can range from exposure of products and materials to salt-contaminated environments, environments with corrosive gases or exposures to UV.

About accreditation

The laboratory holds an accreditation according to SS EN ISO/IEC 17025:2018 (the Swedish version of ISO/IEC 17025:2017) and we are also accredited for 70 specific test methods and standards.

An accredited laboratory is deemed by an accreditation body to meet the requirements of an applicable standard. For laboratories the standard is SS EN ISO/IEC 17025:2018. The accreditation body in Sweden is the government agency Swedac. The standard covers such topics as organization of the laboratory, ensuring of the validity of results, data handling, risk assessment, management systems, metrological traceability and much more. Two things worth mentioning are the impartiality and confidentiality clauses.

The laboratory is bound by the confidentiality clause, meaning that in principle no information obtained for the purpose of the commission from the customer as well as information and results obtained during the commission can be distributed by the laboratory. Even more important is the impartiality clause, where the laboratory must take steps to not be subjected to financial, economic or other pressures that can influence our impartiality. We have to assess these risks and must be able to demonstrate how we minimize them when Swedac performs their review.

Performing tests and evaluations at an accredited laboratory ensures an internationally

recognized high quality and competence level. It is often advantageous to test products at an accredited laboratory as it guarantees impartiality and the results are accepted by certification and government bodies.

Our accreditation also gives us the possibility to incorporate new methods and standards by ourselves. It can be new editions of standards, and standards or methods that we previously were not accredited for, if it is within the scope of our accreditation area. This gives our customer added flexibility as we can meet their demand in a very short time frame.

So, in Borås, Sweden, we can offer testing in an accredited fashion, in order to meet your and your customer quality requirements.

More information

→ ri.se/sv/vad-vi-gor/tjanster/accelererad-korrosionsprovning-saltdimma-och-kondensation

→ ri.se/en/what-we-do/services/chemical-resistance

→ ri.se/en/what-we-do/services/weather-durability-test

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Meeting the demands of industry and society in record time

At the time of publication of this magazine the Covid-19 pandemic is not yet over. In the beginning of spring 2020 it became painfully apparent that the supply of personal protective equipment (PPE) was alarmingly low. At RISE in Borås we have, in record time, set up and tested PPE clothing for the Swedish market.

The European Commission issued an exemption for certain products, for instance PPE clothing used in hospitals and by other health institutions. In Sweden the government and the Swedish Work Environment Authority established a fast track for PPE equipment destined for the healthcare sector so that the lengthy process of CE certification of these products could be reduced. The fast track was based on the harmonized European standard EN 14605:2005 + A1:2009 and the temporary market acceptance was valid until the end of 2020.

Up and running in 3 weeks

In Borås the work with setting up the testing infrastructure as well as studying the regulatory documents and standards started at the end of March 2020 and a fully working operational testing matrix was launched within three weeks. This fast launch was made possible by dedicated personnel in Borås. These personnel set up the testing procedures and, in some instances, build equipment in record time. This would not have been feasible without a well-developed network of complementary competences at RISE and enthusiastic staff and collaboration between several units within RISE.

Some methods in the test matrix were relatively easy to implement, such as tensile testing. Others required a good amount of rapid prototyping to achieve a reproducible and reliable set up, for instance permeability to chemicals.

During the first two months of operation over 40 unique PPE clothing articles have been tested with a turnaround time of a couple of days.

Future of PPE testing

The certification department at RISE is hard at work to secure that all relevant accreditation is obtained to be able to provide CE certification for these kinds of PPE. At the laboratory level we are investigating what kind of testing we have to add to our matrix to be able to support the industry with testing of PPEs of varying protection levels for chemical and biological risks. Not only for the health services, but also for other parts of industry and the public sector.

What's this got to do with corrosion?

Well, not much, but it has everything to do with product durability. This case shows the ability RISE has, not only solve problems using a cross functional approach, but also setting up testing and verification methodologies in a short time while maintaining a high level of quality.

More information

→ ri.se/en/faster-track-approval-personal-protective-equipment

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Thin-film technology – a sustainable multi-metal concept

How does thin-film technology work on mixed-material structures? As part of a Joint Industrial Project, JIP, researchers at RISE along with several international companies have examined corrosion protection using thin-film technology during the pre-treatment of the car body of vehicles.

Achieving effective and long-lasting corrosion protection of the car body requires good adhesion between the protective paint layer and the metal. Today, the automotive industry primarily utilises phosphate pre-treatment of the car body. The phosphating process has an adverse impact on the environment because it requires a large amount of energy and produces large quantities of waste.

– Since the automotive industry currently uses a method that most probably will be prohibited in the future, we must now investigate whether alternative methods can provide the same degree of corrosion protection as traditional phosphating, says Project Manager Carolina Schneiker.

That thin-film technology works well in terms of optimisation based on the properties of a single material is already well known. Therefore, this project has focused on studying how well pre-treatment with thin-film technology works for mixed materials. Another interesting aspect is the method employed to join mixed-materials since both the risk of galvanic coupling and the geometry of the gap may affect the corrosion resistance of the car body.

– An increasing amount of different materials are being used in vehicles, and we do not know how thin-film technology works with mixed materials. If the pre-treatment is not sufficient, the paint will not bond to the car body, and corrosion damage can occur if the paint loose adhesion, says Carolina Schneiker.

The researchers conducted accelerated corrosion tests designed to simulate the road environment in a laboratory, and mobile exposure tests where the samples are exposed on trucks operating daily between Stockholm and Gothenburg. Mobile exposure tests are an important part of the study, since this is the actual environment to which the vehicles will be subjected.

– There is high demand from the industry for development of alternative methods to phosphating, so we hope that the results of the study will be positive, says Carolina Schneiker.

JIP is fully funded by the automotive industry, with a number of companies sharing the costs and the results.

More information

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Challenging agricultural environments demands better coatings for steel

Agricultural buildings are harsh environments for steel. This Joint Industrial Project, JIP, aims to study material performance in agricultural buildings and to evaluate new coating materials for galvanised steel and coil coated steel with respect to these environments.

There are many potential causes of corrosion in agricultural buildings. Animals exhale large quantities of moisture and create high relative humidity if the moisture is not properly vented. High humidity increases the potential for condensation. In addition, large quantities of ammonia may be found, from manure and urine, especially during storage and decomposition. Levels can exceed 50 ppm with lowered winter ventilation rates and reach 100 to 200 ppm in poorly ventilated buildings.

Microbes and corrosion

Additional corrosive agents in agricultural buildings are acids, and salts (from silage and feed residues, cleaning agents, fertilizers, and preservatives), and bacteria causing microbiologically influenced corrosion.

– We initiated this project due to the need to obtain field data in these complex environments, says Nathalie LeBozec, Project Manager.

There are relatively few data concerning these materials in ammonia, fertilizers and other relevant chemicals for agriculture environments.

– This type of project is rather challenging as we need to perform exposures in real agriculture buildings and to measure the climatic conditions in these buildings as a function of time, adds Nathalie LeBozec.

Liquid and atmospheric environments

The aims of the JIP project are:

- To study the material performance of metallic coatings in both liquid and atmospheric

environments in selected animal farming scenarios.

- To study the effect of galvanic coupling (e.g. stainless steel, rebar in concrete) on the corrosion resistance of metallic coatings and on the degradation of coil coating.
- To evaluate new coil coating materials with respect to these environments.

Growing market

Samples are exposed in agriculture buildings used for chickens and cows, and the JIP also has access to agriculture buildings used for ducks and pigs.

– The results are important for the steel industry worldwide as animal farming is an important and growing market for the coil coating industry, says Nathalie LeBozec.

More information

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Material performance of metallic coatings are studied in different agriculture buildings.

Upcoming events

Plastic for pickling committee (PPC)

NOVEMBER 3, 2020

Location: Online
Contact: Love Pallon,
love.pallon@ri.se
ri.se/en/mrc-ppc

Member Research Consortia Day

NOVEMBER 4, 2020

Location: Online
Contact: Jeanette Almquist,
jeanette.almquist@ri.se

MRC Automotive Corrosion Day

NOVEMBER 10, 2020

Location: Online
Contact: Carolina Schneiker,
carolina.schneiker@ri.se
ri.se/en/mrc-automotive

MRC Soil Day

DECEMBER 2, 2020

Location: Online
Contact: Erwan Diler, erwan.diler@institut-corrosion.fr

Seminar of materials in contact with drinking water

MARCH OR APRIL 2021

Location: Stockholm/online
Contact: Mylene Trublet,
mylene.trublet@ri.se
ri.se/en/what-we-do/networks/
material-in-contact-with-
drinking-water

8th International Seminar in the Field of Automotive Corrosion

MAY 2021

Location: Stockholm/online
Contact: Carolina Schneiker,
carolina.schneiker@ri.se
ri.se/en/mrc-automotive

MRC spring meetings

MAY OR JUNE 2021

Location: Stockholm/online
Contact: Jeanette Almquist,
jeanette.almquist@ri.se

Member Research Consortia Day

AUTUMN 2021

Location: Stockholm/online
Contact: Jeanette Almquist,
jeanette.almquist@ri.se

Due to the Covid-19 pandemic, most of our events are held online. The programs may be changed and new events scheduled. For updated information, please contact us.

More information

✉ mylene.trublet@ri.se

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