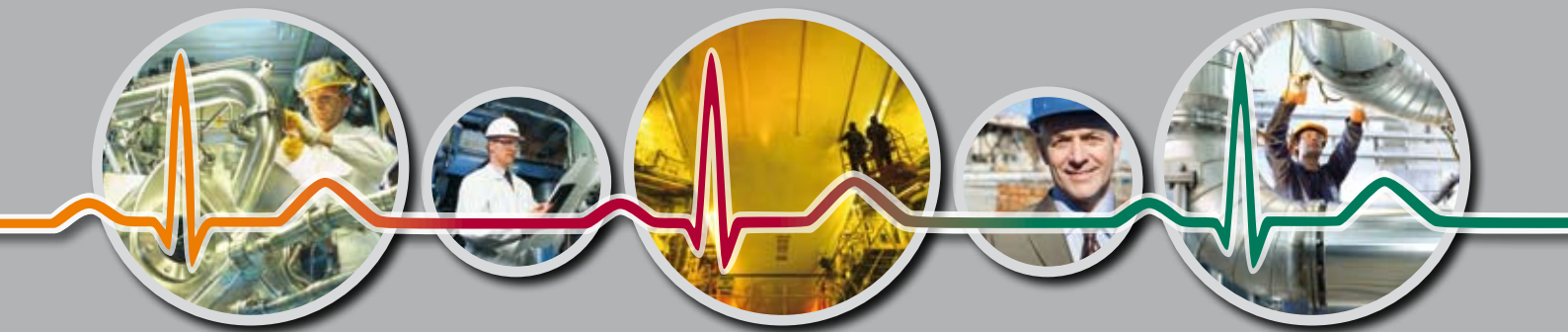


Professional Materials and Corrosion Solutions

Engineering Expertise for Your Plant Performance Challenges



INNOVATION

ENGINEERING

OPTIMIZATION



Bayer Technology Services
Powering Your Performance



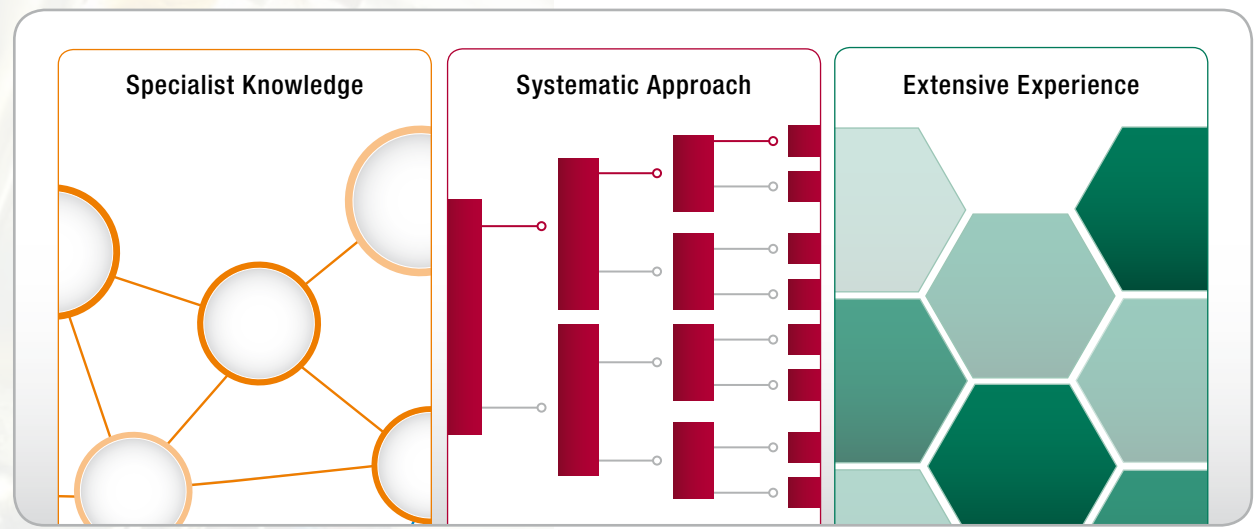
BAYER TECHNOLOGY SERVICES

Expertise Provided

by Origin and Experience

Renowned Name – Premium Performance

Our origin as a subsidiary of the Bayer Group has provided us with the extensive experience of several decades of hands-on activity within the chemical, petrochemical, and pharmaceutical industries worldwide. We develop tailored, industry-specific, and holistic consulting and engineering solutions for our customers. Our aim is to boost our customers' performance by providing them with practical, economic, and robust solutions to ensure optimal asset health and availability.



The three pillars of our success

We are a successful global player with offices in eleven countries all over the world. You can benefit from our long-term operational and logistical experience, no matter if your facilities are located within Europe, the Middle East, the Americas, or Asia. Just contact our experts and eliminate reliability, performance, or availability challenges within your production cycle. Once and for all.

The three pillars of our success are:

- Our **specialist knowledge** of all materials, major chemicals, processes, and material damage mechanisms.
- Our **systematic approach** supported by world-class laboratories.
- Our **extensive experience** in solving process, materials, and corrosion problems.

Materials and Corrosion under Holistic Expert Control

We are a highly professional team of materials scientists and engineers, assisted by a best-in-class accredited laboratory (DIN EN ISO 17025 and DIN EN ISO 9001). We provide high-level expertise in the fields of materials characterization, testing, and materials degradation mechanisms for the chemical, petrochemical and pharmaceutical industries. Our multidisciplinary approach to managing materials- and corrosion-related risks gives us a holistic and business-oriented understanding of your plant and its corrosion management requirements. You can fully rely on our extensive knowledge and owner-operator experience from decades of close working relationships with plant personnel in several industry sectors worldwide.

Why is Bayer Technology Services the Right Partner for Your Business?

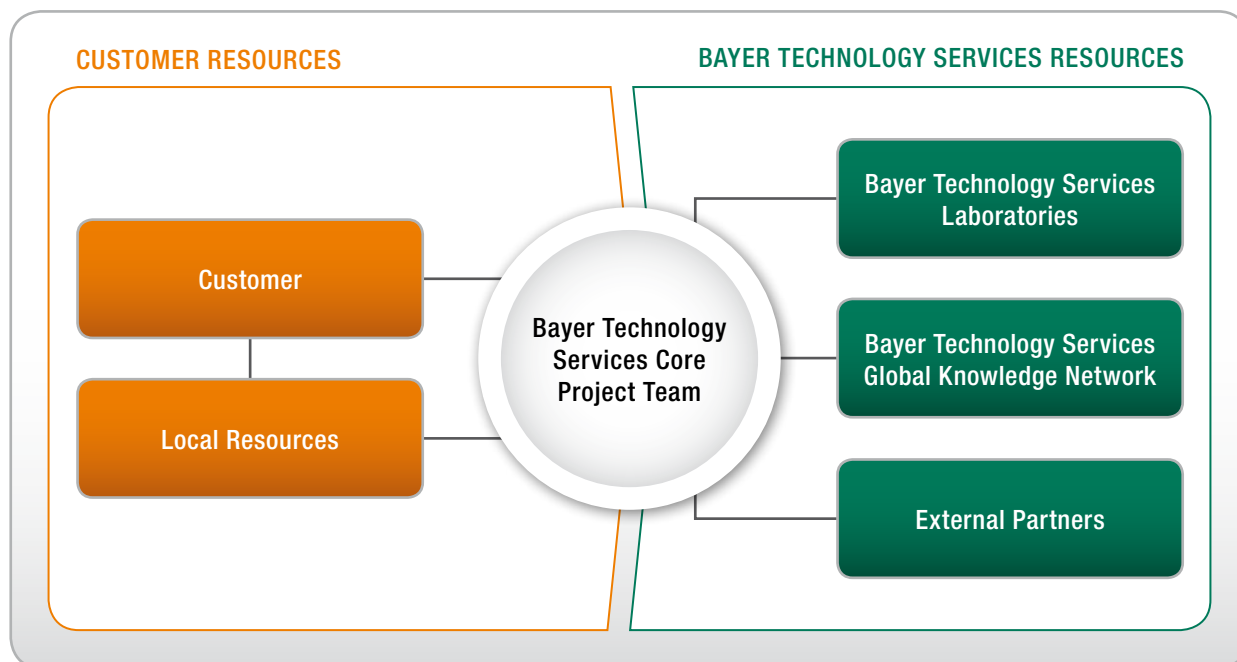
- We possess decades of owner-operator experience in providing solutions for the chemical, petrochemical, and pharmaceutical industries.
- We rapidly mobilize a multidisciplinary team in response to the needs of your business, anywhere in the world.

- Our specialists deliver a valid and intelligent action plan that matches the urgency and seriousness of the situation.
- Our specialists command a complete “toolbox” for solving materials performance problems, including best-in-class materials, condition monitoring, corrosion monitoring, and analytical laboratories.
- We are highly networked, both within and outside of Bayer Technology Services, and can draw on specialized knowledge and skills in support of your requirements.

Leverage the Bayer Technology Services Global Knowledge Network

For complex, large, or urgent projects, we draw on manpower, expertise, and resources from within the Bayer Technology Services organization and an external global network of highly qualified partners and local alliances.

This means that you benefit from a robust and top-notch solution for a complex project or even routine tasks managed through a single service provider.



Leverage the Bayer Technology Services Global Knowledge Network

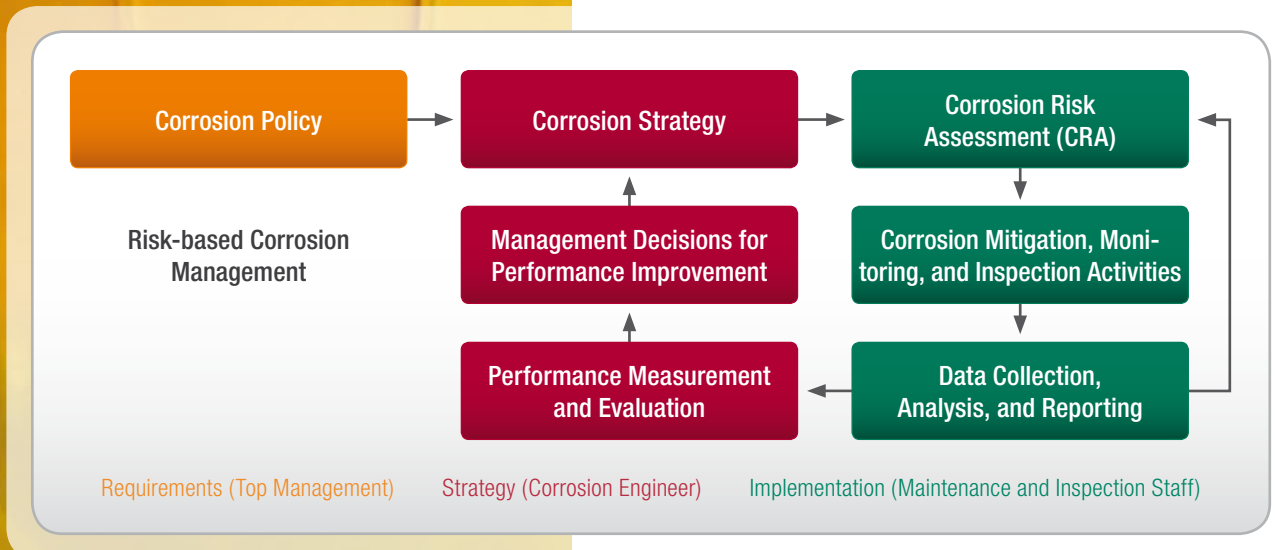


A PROACTIVE FRAMEWORK FOR CORROSION MANAGEMENT

Our Concept: Advise, Implement, Optimize

Benefit from our deliberate and proactive strategy for the management of corrosion risks throughout the total lifecycle of your plant assets. Bayer Technology Services supports you in the specification, implementation, and sustainment of a lean and robust framework for Corrosion Management, i.e., a Corrosion Management System (CMS).

Our concept of Corrosion Management (CM) encompasses the development, implementation, and review of a corrosion policy tailored to your specific business circumstances. Our robust CMS ensures the identification and implementation of optimal corrosion management strategies for your plant.



The challenges involved in establishing a robust, sustainable CMS are significant. CM is a process that spans the height and breadth of your organization. It requires the commitment and cooperation of all employees, from the top management to the ground-level workforce. Only the collaboration of multiple disciplines, e.g., process, reliability, maintenance, inspection, and planning personnel, secures optimal results.

Bayer Technology Services emphasizes the importance of a multidisciplinary team consisting of chemical, metallurgical, and corrosion engineers and scientists to assist companies in establishing a robust site-specific CMS. Our team of experts tailors the CMS to the requirements of your business, thereby ensuring the realization of your lifecycle, cost-of-ownership, reliability, and performance targets.

Our Approach: Analyze, Understand, Solve

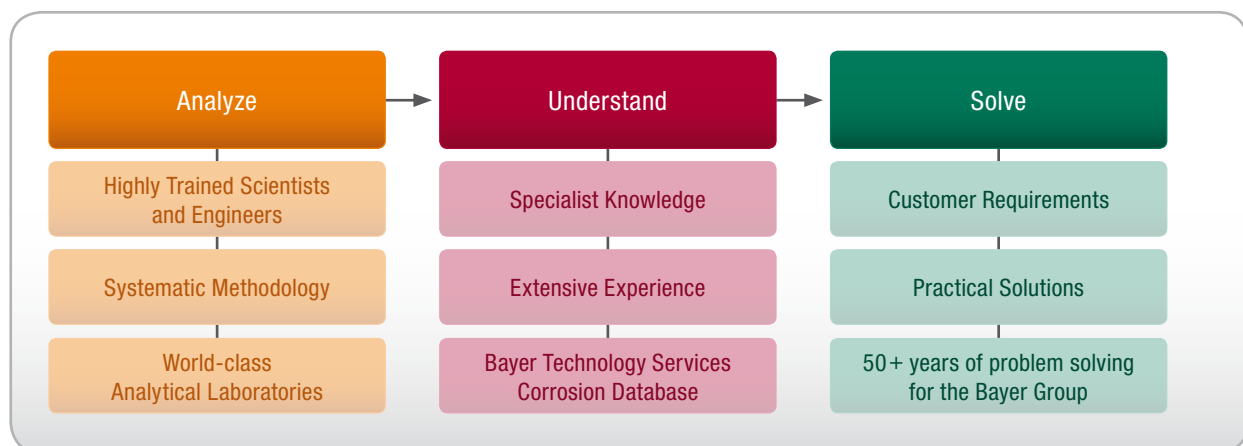
Bayer Technology Services employs a systematic approach to solving customer problems. As your reliable and experienced partner for efficient corrosion management, our world-class staff approaches all problems in a systematic and professional manner, with expert knowledge and tools.

This means that you benefit from practical solutions to address all problems in corrosion management. Depending upon your requirements, we may adopt either:

- a top-down approach to address managerial and strategic requirements, or
- a bottom-up “troubleshooting” approach to resolve specific problems.

The response of a material to applied chemical, mechanical, and thermal conditions is complex and can be highly sensitive to parameter changes. Bayer Technology Services’ comprehensive understanding of the most complex corrosion systems and the resulting damage mechanisms affecting your equipment guarantee a solution that matches your process and business needs.

A specially selected expert team analyzes, understands, and solves your problem. Our staff methodically analyzes the problem in the context of your process plant, and is equipped with the best available tools for investigating and advising on material performance problems.



Our Approach: Analyze, Understand, Solve

Maximum Flexibility for a Reactive Response

The “bad actors” jeopardizing your productivity will not wait for the implementation of a site-specific Corrosion Management System. In cases of emergency, Bayer Technology Services adopts a so-called bottom-up “troubleshooting” approach. We thus assist you in developing and implementing economical and reliable solutions to your most urgent and/or costly materials- and corrosion-related challenges. We mobilize a specially selected expert team on-site to assist you in pressing cases. Trust our expert teams for a fast reaction even at short notice. We maintain an on-site presence to tackle your asset challenges as long as you need us.



A PERFECT PRODUCT FOR ALL SEASONS

We Deliver Professional Solutions when You Need them

Our product portfolio applies to your complete asset lifecycle and addresses all technical corrosion management requirements:

DESIGN

- **Reliability-centered Design (RCD):** A critical review that identifies design configurations that may lead to in-service damage, loss of process performance, or loss of production.
- **Materials Selection:** Materials selection is based on your process operating window and ensures optimum material selection to technical and cost requirements.

FABRICATION

- **Quality Assurance and Control:** Our Quality Management concept is a robust, risk-based approach for the identification, assessment, and mitigation of equipment fabrication risks.

OPERATION

- **Materials and Corrosion Study/Audit:** A systematic assessment of your process system identifies potential damage mechanisms and likely damage rates.
- **Corrosion Risk Assessment (CRA):** The CRA is based upon the materials and corrosion study, additional plant data, and your corporate risk matrix.
- **Corrosion Monitoring:** Inspection and monitoring techniques are selected based on the degradation mechanism and the risk of failure. For critical equipment, trust the Bayer Technology Services product baycorroxxion® for the collection of high-quality real-time corrosion data.
- **Corrosion Prediction:** Material corrosion behavior is based on our detailed understanding of your corrosion system. In instances where corrosion data is available, the corrosion system may be analyzed using the Bayer Technology Services neural network analysis software bayPRINCE®.

END-OF-PLANT LIFE PERIOD

- **Condition Assessment:** We assess your damaged equipment based on our extensive experience, or alternatively based on rigorous engineering assessment.
- **Root-cause Failure Analysis (RCFA):** The mechanistic and root causes of equipment failure are identified based on an examination of the failed component and actions to prevent similar failures are recommended.

A COMPLETE TOOLBOX FOR ACTIVE CORROSION MANAGEMENT

Analytical and Technical Expertise for Your Asset Integrity and Reliability

METALLOGRAPHY AND MECHANICAL TESTING

- Metallography
- Fractography
- Tensile testing
- Hardness and micro-hardness testing
- Impact toughness testing
- Adhesion and peel strength (non-metallic materials)

CORROSION TESTING

- High-pressure and temperature corrosion tests under electrochemical control
- Electrochemical measurements including voltammetry and electrochemical impedance spectroscopy
- Laboratory corrosion tests (metallic & non-metallic materials, coatings, and liners):
 - Simulated equipment conditions in a laboratory or pilot plant environment, e.g., heat-transfer conditions even with hazardous chemicals
 - Cathodic disbonding testing (coatings)
 - Adherence tests (coatings and liners)
 - To ASTM A262 and G28 (intergranular corrosion), G48 (pitting corrosion) and G31 (immersion testing), ferric chloride tests, Cabot tests at elevated temperature
- Field-corrosion test coupons

MATERIAL IDENTIFICATION

- X-ray Fluorescence analysis (XRF)
- Energy Dispersive X-ray analysis (EDX)
- Differential Scanning Calorimetry (DSC)
- Infrared Spectrometry (IR)
- Thermo Gravimetric Analyzer with coupled Mass Spectrometer (TGA-MS)
- Classical chemical or spectroscopic analysis methods
- Positive Metal Identification (PMI)
- Qualitative Polymer Identification

MATERIAL CHARACTERIZATION

- Specific surface area and porosity determination
- Transmission Electron Microscopy (TEM)
- High-resolution and Environmental-scanning Electron Microscopy (HRSEM and ESEM)
- Classical Microscopy
- Confocal Laser Scanning Microscopy (CLSM)

SURFACE ANALYSIS

- Surface roughness measurement
- Atomic Force Microscopy (AFM)
- Time of Flight – Secondary Ion Mass Spectrometry (ToF-SIMS)
- X-ray Photoelectron Spectroscopy (XPS, ESCA)

CONDITION MONITORING

- Real-time corrosion monitoring (baycorroxxion®) in chemical processes
- Lubricant degradation and contamination monitoring
- Vibration monitoring and diagnostic of rotating equipment
- Investigation of structural resonance conditions
- Stress and strain measurement and monitoring

NON-DESTRUCTIVE EXAMINATION (NDE)

- Visual and endoscopic inspection (VT)
- Magnetic particle testing (MT)
- Penetrant testing (PT)
- (Digital) Radiographic testing (RT)
- Ultrasonic testing (UT), including phased array and IRIS technologies
- Eddy-current testing (ET)
- Helium leak testing (LT)
- Other advanced test methods are available from our partners.





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