CORROSION SCIENCE AND ENGINEERING

Corrosion, the environmental degradation of materials, is a major area of research in materials science and engineering. It is estimated that corrosion costs U.S. households, businesses and government agencies more than $400 billion dollars a year. In the MSE department at Ohio State, research conducted at the Fontana Corrosion Center (FCC) focuses on the study of aqueous corrosion in the effort to develop better methods to protect materials from the adverse impacts of the environment. With a direct link to this research and these facilities, CDME and industry partners have first access to cutting edge anti-corrosion research and methods. Topics of research at the FCC, which has earned an international reputation for excellence, include:

- Mechanisms of localized corrosion
- Fundamental studies of corrosion inhibition
- Development of environmentally-friendly protective coating systems
- Studies of coating adhesion and degradation
- Predictive modeling of corrosion damage accumulation
- Novel applications of scanning probe microscopy to corrosion
- Corrosion and cracking of steel and H2S-containing environments

MAIN RESEARCHER

Rudolph G. Buchheit is Professor and Associate Dean for Academic Affairs Administration in the College of Engineering and Co-Director of the Fontana Corrosion Center. He earned a BS in Engineering Science at Loyola University Maryland, and MS and PhD in Materials Science from the University of Virginia. He was a Senior Member of the Technical Staff in the Materials and Process Sciences Directorate at Sandia National Laboratories New Mexico until joining the faculty in the Fontana Corrosion Center in Materials Science and Engineering at Ohio State. He has served as Department Chair of Materials Science and Engineering at Ohio State.

His research is in the area of corrosion science and engineering, with emphasis on the chemistry and electrochemistry of corrosion, localized corrosion, corrosion protection, corrosion modeling and corrosion prediction. He has also worked in the area of corrosion inhibition, surface modification and corrosion resistant coatings.

THE RESEARCH

Corrosion science and engineering have benefited tremendously from the explosion in the use of electrochemical methods that can probe the thermodynamic and kinetic aspects of corrosion, including the rate of corrosion. These methods have proved of great utility to corrosion engineers and scientists in predicting the performance of materials and devising corrosion mitigation strategies, understanding the effects of changes in process and environment conditions, and assessing the accuracy of corrosion monitoring techniques.

Enhanced prevention and understanding of corrosion has been achieved over the past several decades by applying these methods in both the laboratory and field. Electrochemical methods for corrosion, when used properly, have distinct advantages over exposure techniques. Some of these advantages are speed, nondestructiveness, high resolution, and ability to provide mechanistic information. Unfortunately, few engineers and scientists tasked with corrosion problems have been trained in electrochemical fundamentals and their application to corrosion phenomena.
THE MARKET

Anti-corrosion has a projected global demand of $26.5 B by 2019. The growth of this market is expected to expand at a moderate rate with advancements in coating technology, increasing corrosion losses, and a rise in demand from sectors such as power generation and infrastructure.

Development of new products is the focal point for the anti-corrosion coating industry. Major initiatives are aimed at creating new variants of coating, with better performance qualities that align with evolving environmental regulations. The procedures for anti-corrosion coating are also concentrating on developing new technologies. The corrosion industry has seen a shift from the production of solvent borne coatings to water-borne coatings due to tightening regulations. The major initiatives are for decreasing harmful VOC emissions in the anti-corrosion coatings while still maintaining and improving the quality and performance of the coating. The companies invested in the market are investing in the creating of new facilities, mainly in emerging regions. They are also trying to widen their global presence to address the growing demand in emerging markets. All of these developments are a reaction to the increasing demand for anti-corrosion coating in emerging regions with a high development rate.

Goals

Researching anti-corrosion practices in order to develop improved methods to protect materials against environmental damage. CDME plans to take this research and apply it to projects for their industry partners and their manufacturing efforts.

Categories

Corrosion, Corrosion Science, Anti-Corrosion Methods, Science and Engineering, Chemistry and Electrochemistry of Corrosion

College

College of Engineering (COE)

Intellectual Property

US 7696453B2
“Chromium-Free Welding Consumable”

US 20040216637A1
“Corrosion Resistant Coating with Self-healing Characteristics”

US 5972518A
“Corrosion Protection of Iron/Steel by Emeraldine Base Polyaniline”

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