Topical issue on “Electrochemistry of cathodic and anodic control of corrosion”

Su-Il Pyun • Heon-Cheol Shin

Published online: 5 January 2014
© Springer-Verlag Berlin Heidelberg 2014

Over the past few decades, there has been great progress in corrosion science and engineering. As a result, a greater number of corrosion-related issues can now be explained theoretically than has been done before. However, many problems are still partially resolved by experience as corrosion processes are often too complicated to be described by a theory. Understanding what is behind a specific corrosion phenomena and accordingly establishing a theory to explain it, allows for proper materials to be selected against corrosive environments and allows us to predict the lifetime of the material. These will result in quality assurance and prevent the catastrophic failure of materials, respectively. An in-depth study on corrosion phenomena, including the monitoring of the correct factors that can allow us to accurately determine the extent of corrosion, finding the cause for specific corrosion cases, selecting/developing proper corrosion-resistive materials, and improving methods for preventing corrosion, will, no doubt, make a tremendous impact on our modern technology-based society.

This topical issue of the Journal of the Solid State Electrochemistry covers a wide range of topics on corrosion science

and technology, in the view point of cathodically and anodically controlled corrosion. The opening article reviews electrokinetic phenomena in materials science. The following review article focuses on high-temperature stress corrosion cracking. The studies on the effects of electrolyte (metal cations, pH, temperature), surface treatment (PEO coating, surface area, barrier-type oxide film), and electrical driving force (potential oscillation) explore the very basics of the mechanism of corrosion, which is still a matter of great concern and interest from both a practical and theoretical perspective. Electrochemical impedance spectroscopy has been successfully utilized in studies on microbiologically induced corrosion of iron and steel. Other studies on the porous NiO structure, strontium-doped lanthanum manganite (LSM)/gadolinium-doped ceria (GDC) composite, and (Mn,Cu)₃O₄-based conductive coatings show how an understanding of the corrosion process can be potentially useful in preparing and characterizing high-performance functional electrochemical devices.

The issue covers only a fraction of the work on modern corrosion science and technology. Nonetheless, the papers chosen for this special issue are quite noteworthy and should not be missed. We hope that they are informative and beneficial to the readers in this field. With heartfelt thanks to Prof. Fritz Scholz and Dr. Michael Hermes, we are deeply grateful to all authors and reviewers for their efforts and time. Finally, one of the editors (Heon-Cheol Shin) would like to pay sincere respect to Dr.-Ing. Su-Il Pyun for his lifelong passion for research, giving special meaning to this topical issue that is published on his 72nd birthday.

S.-I. Pyun (✉)
Department of Materials Science and Engineering, Korea Advanced
Institute of Science and Technology, #373-1, Guseong-dong,
Yuseong-gu, Daejeon 305-701, Republic of Korea
e-mail: sipyun@kaist.ac.kr

H.-C. Shin
School of Materials Science and Engineering, Pusan National
University, San 30, Jangjeon-dong, Geumjeong-gu, Busan 609-735,
Republic of Korea
e-mail: hcshin@pusan.ac.kr