metals

Editorial

High Temperature Corrosion and Oxidation of Metals

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1. Introduction and Scope

Corrosion costs heavily, and its prevention is a multi-billion-dollar industry. Among various types of corrosion, corrosion at high temperatures contributes considerably to the maintenance expenditures in various industries such the high temperature processing (e.g., petrochemical, oil and gas, metallurgy, manufacturing, and power production), new renewable energy technologies (e.g., solar thermal), and other critical high temperature components (such as aircraft engines, turbines, and power plant boilers). The literature on high temperature gaseous corrosion essentially spans a wide range of ferrous and non-ferrous metals/alloys and operating conditions. The critical relevance of high temperature corrosion to some of the topical fields (e.g., renewable energy and supercritical power plants) has witnessed a renewed focus on the mechanistic understanding of high temperature oxidation, hot corrosion in the presence of sulphur and chloride containing contaminants, corrosion in supercritical water/CO_2 systems and passivation, as well as on corrosion mitigation strategies including microstructural modification, alloying, coatings, and cathodic protection. Materials compatibility is also of prime importance to new technologies, such as concentrating solar power systems, which use molten salts and liquid metals as energy storage media and/or heat transfer fluids at high temperature. Molten salt corrosion is fundamentally different as compared to air oxidation as the solubility of the corrosion products and acidic/basic fluxing in the melt tend to hugely impact the corrosion mechanism. MCrAlY coatings, cathodic protection using bivalent metal addition and refractory metal alloying have been shown to be effective in high temperature oxidation mitigation.

2. Contributions

This Special Issue of *Metals*, on "High-Temperature Corrosion and Oxidation of Metals" presents articles on some of the aspects described earlier.

There is an article on oxidation resistance of some critical components of the fusion reactors which is a cutting-edge futuristic topic [1]. Tungsten-base alloys are among main candidates for such applications because of their very high melting point, high thermal conductivity, low tritium retention, and low erosion yield. The article presents oxidation of Cr and Y containing tungsten alloys.

One of the articles reports the role of the variation in surface microstructural patterns of nickel in morphology of the oxide scales [2]. Patterned surfaces find relevance to electronics, batteries, and solar cells.

Another article reports oxidation behaviour of relatively new Ni–Y and Ni–Ta alloys [3]. Such alloys are attractive for applications, such as aerospace systems, gas turbine blades, and interconnects of solid oxide fuel cells.

NiCoCrAlYTa-based thermal barrier coatings have been investigated for quite some time [4]. An article in the issue reports the role of Pt-addition and processing parameters on failures under thermal cycling conditions, with the help of microscopic characterization.

Use of carbon anodes in aluminum processing involves high energy consumption and causes a serious pollution concern. An article in the issue explores an alternative material, Fe–Ni–Al Alloy, and investigates corrosion behavior of the alloy in a cryolite melt [5].

3. Conclusions and Outlook

As the Guest Editors, we are very thankful to the authors for their valuable contribution to the special issue. We are also very thankful to the Metals editorial team, in particular to Mr. Toliver Guo for their continuous support and timely actions during the development of this special issue.

Conflicts of Interest: The authors declare no conflict of interest.

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