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Editorial on the Advanced Characterization Techniques for Studying High-Temperature Corrosion

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The following papers are from selected presentations in the “Advanced Characterization Techniques” session of the 11th International Conference on High-Temperature Corrosion and Protection of Materials (HTCPM-2024) in June 2024 in Les Embiez, France.

Characterization techniques enable the identification of the fine nature of oxide scales developed on the surface of metallic alloys, as well as any chemical and

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structural modifications of the metal beneath the oxide scale. Using a combination of characterization techniques often allows us to discover the material's constitution in detail, enabling us to understand oxide growth mechanisms and corrosion phenomena.

These papers bring together studies on the oxidation of mainly nickel-based materials (from pure Ni through chemically graded materials to industrial alloys), pure copper, and ferrite-pearlitic steels. Various combined characterization techniques are used, with electron microscopy being associated with another characterization technique, such as:

- In situ environmental scanning electron microscopy (SEM) and transmission electron microscopy (TEM)
- Dual-focused ion beam scanning electron microscopy (FIB-SEM) and TEM
- In situ environmental TEM
- SEM and Raman spectroscopy maps; and
- SEM and acoustic emission signals.

In situ SEM and TEM characterization techniques with a low oxygen partial pressure (from 0.03 to ~30 Pa) are often used, highlighting the nature of transient oxides or the role played by grain orientation on oxide nucleation and growth. For example, the effect of nitrogen in the reaction gas on oxidation mechanisms in Ti alloys or crack propagation modes (thanks to an acoustic emission signal study) is discussed herein.

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