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► **To cite this version:**

Stéphane Mathieu, Jérôme Favergeon, Bruce Pint, Daniel Monceau, Clara Desgranges, et al.. Editorial on oxidation in complex atmospheres. *High Temperature Corrosion of Materials*, 2024, 101, pp.1263 - 1264. 10.1007/s11085-024-10318-y . hal-04889550

HAL Id: hal-04889550

<https://hal.science/hal-04889550v1>

Submitted on 15 Jan 2025

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Editorial on Oxidation in Complex Atmospheres

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Published online: 5 October 2024

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The atmospheres surrounding metal parts in many industrial processes rarely comprise a single oxidant. Whether in fossil energy conversion plants, nuclear power plants, jet engines, chemical or petrochemical production routes, several molecules, sometimes present as main components, sometimes at the impurity level, play a role in corrosion mechanisms. Current research into the development of low-emission technologies also clearly demonstrates the importance of considering, in addition to O₂, the effects of H₂, H₂O, NH₃, etc. in the development and selection of alloys.

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This collection of papers considers many situations where oxidation competes with, for example, carburizing, nitriding, and sulfidizing reactions and where water vapor can have a significant impact in cases where, at first glance, it would not even be considered. The papers include studies on the effect of H_2 and/or H_2O on pure titanium, on chromia scale, but also the benefits of alumina-forming alloys for many complex environments, as well as the subtle effect of Mn and Fe on the metal dusting resistance of NiCu alloys, highlighting the relevant assistance of thermodynamic and ab initio calculation to address these complex corrosion issues.

The following papers are contributions from the “Oxidation in Complex Atmospheres” session of the 11th International Conference on High-Temperature Corrosion and Protection of Materials (HTCPM 2024), held at Les Embiez Island, France, on 9–14 June 2024.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.