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X-Ray Photoelectron Spectroscopy Characterization of the Surface Layer on Inconel 625 after Exposition in Molten Salt

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Abstract : This study is part of the international research - Materials for Molten Salt Reactors (MSR) and addresses the part of the project dealing with the corrosion behavior of candidate construction materials. Inconel 625 was characterized by x-ray photoelectron spectroscopy (XPS) before and after high–temperature experiment in molten salt. The experiment was performed in a horizontal tube furnace molten salt reactor, at 450 °C in argon, at atmospheric pressure, for 150 hours. Industrially produced HITEC salt was used (NaNO3, KNO3, NaNO2). The XPS study was carried out using the ESCAProbe P apparatus (Omicron Nanotechnology Ltd.) equipped with a monochromatic Al Kα (1486.6 eV) X-ray source. The surface layer on alloy 625 after exposure contains only Na, C, O, and Ni (as NiOx) and Nb (as NbOx BE 206.8 eV). Ni was detected in the metallic state (Ni0 – Ni 2p BE-852.7 eV, NiOx - Ni 2p BE-854.7 eV) after a short Ar sputtering because the oxide layer on the surface was very thin. Nickel oxides can form a protective layer in the molten salt, but only future long-term exposures can determine the suitability of Inconel 625 for MSR.

Keywords : Inconel 625, molten salt, oxide layer, XPS
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