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EVALUATION OF COBALT FREE COATINGS AS HARDFACING MATERIAL CANDIDATES IN SODIUM FAST REACTOR

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The need for materials having good tribological properties in Sodium Fast Reactors has been identified (SFR) from the first reactors operation. Where galling or adhesive wear cannot be tolerated, hardfacing alloys or galling-resistant coatings are usually applied on rubbing surfaces. The most used coating is the cobalt base alloy named Stellite because of its outstanding friction and wear behavior. Nevertheless, cobalt is an element which activates in the reactor leading to complex management of safety during reactor maintenance and decommissioning. As a consequence, a collaborative work between CEA, EDF, AREVA and French academic laboratories has been launched for selecting promising cobalt free hardfacing alloys for SFR applications.

Several nickel base alloys and aluminides have been selected from literature review then manufactured on two candidate steel grades: 9Cr ferritic-martensitic steel EM10 and 18Cr austenitic steel AISI 316L(N). Nickel base alloy coatings were deposited through Plasma Transferred Arc or Laser Cladding, and the aluminides coatings, through pack cementation or slurry. Among the numerous properties required for qualifying their use as hardfacing alloys in SFR, good corrosion behaviour and good friction and wear behaviour in sodium are essential. The results obtained on these properties are shown in this presentation.

First, the corrosion behaviour of all coatings was evaluated through exposure tests in purified sodium for 5000 h at 200 °C and 550 °C. The degradation of the surface was carefully measured thanks to several complementary analysis techniques (GD-OES, FESEM, XRD, ...).

Finally, the friction and wear properties of all candidates were evaluated in sodium in a newly designed facility. The influences of temperature and of oxygen content in sodium on these properties are detailed.

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