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## Corrosion protection of a carbon steel in nuclear power plant secondary circuit conditions by film-forming amines: an impedance study

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During layup periods of pressurized water reactors (PWRs), corrosion phenomena can affect metallic components of the secondary circuit, mainly carbon steel. The use of corrosion inhibitors such as film-forming amines (FFA) is an interesting way to attenuate or stop these phenomena and extend the lifetime of the materials. FFA have both a hydrophilic head which can adsorb on metals or oxides films and a hydrophobic tail which can organize rather perpendicularly to the surface and create a protective barrier between the metal and the oxidizing species.

The aim of the present work was to investigate the effectiveness of octadecylamine (ODA) for the carbon steels protection under various physical and chemical conditions, representative of the PWR secondary circuits. Carbon steel plates were submitted to different treatments at temperatures between 120 °C and 275 °C in an autoclave with or without ODA. The adsorption of the FFA on the carbon steel surface was characterized at room temperature by contact angle measurements and scanning electron microscopy (SEM). Electrochemical impedance measurements were performed in a Na<sub>2</sub>SO<sub>4</sub> 10<sup>-3</sup> M solution to characterize both the corrosion inhibition efficiency of the ODA and to follow the film behaviour with immersion time. From the impedance data analysis [1], the films thicknesses were extracted and were about 15-20 nm, regardless of the different treatments.

### Reference

[1] J. Baux, N. Caussé, J. Esvan, S. Delaunay, J. Tireau, M. Roy, D. You, N. Pébère, Impedance analysis of film-forming amines for the corrosion protection of a carbon steel, *Electrochim. Acta*, 283 (2018) 699-707.