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Comprehensive investigation of the corrosion state and surface properties of the stainless steel tubes of steam generators

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Evaluating the water chemistry in the primary circuit and the effect of chemical decontamination of the heat exchanger tubes performed by the AP-CITROX (AP: alkaline permanganate; CITROX: citric and oxalic acid) procedure at Paks NPP (Hungary), a project dealing with the comprehensive investigation of the general corrosion state of the steam generators (SGs) has been initiated. Owing to the fact that there is no investigation method available for the in-situ monitoring of the inner surfaces of heat exchanger tubes, a research program based on sampling as well as on ex-situ electrochemical (voltammetric) and surface analytical measurements (SEM-EDX, CEMS, XRD, XPS) was developed and elaborated.

In the time period of 2000-2008 - within the frame of the above project - 45 stainless steel specimens, cut out from various locations of the steam generators of the Paks NPP were investigated. Based on the measured corrosion characteristics (corrosion rate, thickness and chemical composition of the protective oxide-layer) it was found that these parameters are strongly dependent on the decontamination history of steam generators. The present work gives a brief overview on the general corrosion state of the heat exchanger tubes of SGs, concerning the long-term effects of the AP-CITROX procedure on the chemical composition and structure of the protective oxide-layer.

Keywords: stainless steel, steam generator, corrosion, decontamination

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