Influence of Corrosive Environments on Steels Studied by Positron Annihilation Spectroscopy

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Abstract. Corrosion is one of the negative effects influencing the current structural materials of nuclear power plants. The adequate corrosion resistance of structural materials, including austenitic stainless steels, has to be also considered in new designs of nuclear power plants. One of the approaches leading to the improvement of the corrosion resistance of steels goes through surface modifications. In this work, the influence of specimens surface treatment on their corrosion resistance was studied on materials for supercritical water reactor (SCWR) applications. The surface of the steels was prepared by different techniques, including sandblasting, polishing, shot peening and machining, in order to obtain information on the point defects behaviour after exposure to the supercritical water for various exposure times. The microstructural changes of studied steels 800HT and 310S were investigated by Pulsed Low Energy Positron System (PLEPS) [1,2]. A very distinct depth profile of point defects was observed in polished specimens, and the results indicate a significant decrease of the positron diffusion towards the surface in all mechanically modified samples. The increase of the SCW exposure time led to a clearly visible change in the obtained positron lifetimes, i.e., in the size of microstructural defects.