

Investigation on Initial Defect Structures in Unirradiated Reactor Pressure Vessel Steels by Positron Lifetime Measurements

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Abstract

Positron lifetime (PL) measurements on the three kinds of reactor pressure vessel (RPV) steel and one kind of Linde 80 weld were performed at room temperature with a fast coincidence system to investigate initial defect structure and to prepare baseline PL parameters for future comparison with that of irradiated one. Optical microscope (OM) and transmission electron microscope (TEM) was used for microstructural characterization. The RPV steels showed largely the same tempered bainite microstructure, however, noticeable differences were observed in the grain size, distribution of cementite, and bainitic lath width. Variations in positron lifetime among the three kinds of RPV steel of similar chemical composition were definitely observed and were interpreted as the difference in initial defect structures originated from the different manufacturing process. In the case of the Linde 80 weld, the longer lifetime component which did not appear in the RPV steels was discussed in terms of nonmetallic inclusions.