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The role of nano sized defects in the Fe-Cu alloy studied by magnetic nuclear scattering

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Fe-Cu alloys are commonly used for a simulation of radiation damage of RPV steel because a neutron irradiation enhances the copper precipitate which is known as the primary reason of a RPV embrittlement. An investigation of thermal aged Fe-Cu model alloy has been a common and adequate alloy for a study of this purpose. For this purpose the selected annealing temperature is sufficiently low (753 K) compare with the solubility limit (e.g. 1023 K for Fe-1wt% Cu). The behavior of copper precipitations in the Fe-Cu alloy which is used as a simulation of radiation damage was investigated using a small angle neutron scattering (SANS). The alloy was made through a melting with pure Fe and pure Cu. Initially, the alloy is 10% cold rolled, and isothermally aged at 753 K for 20, 200 and 1800 min. The CRPs sizes, volume fractions and A-ratio of Fe-Cu alloy with aging time are obtained from the SANS data analysis. The sizes of Cu precipitates nearly constant up to aging time of 200 min and fast increased, but the volume fraction of Cu precipitates linearly increased with aging time. The investigation is focused on the behavior of copper precipitates with aging time in the 10% cold rolled Fe-Cu alloy. The objective is to identify the aging time dependence of precipitates evolution such as volume fraction and size distribution.

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