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Microstructural evolution of ODS alloys under high helium accumulation rates

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In spite of intensive international research on Oxide Dispersed Strengthened (ODS) steels in the last decade, many fundamental issues concerning modification of steel properties under fusion environment are still under debate. The main objective of this research project is to demonstrate the role of the different microstructural components in radiation resistance of ODS steel under high accumulation rate of transmutation gases. Mechanisms of helium accumulation by different types of microstructural defects were investigated by means of ion implantation technique followed by transmission electron microscopy investigations. It was demonstrated that grain boundaries play the main role in the He accumulation independent of the implantation conditions applied. At that, Y2O3 nanoparticles even though act as centers for gas bubble nucleation have a minor effect on suppression of the He accumulation with impact similar to that of carbide precipitates and dislocations. Potential risks of ODS steel performance under the expected operational conditions are discussed.

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