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Evolution of Al-containing phases in ODS steel by hot pressing and annealing

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Abstract: The crystal structures of Al_2O_3 and Y-Al-O particles in the as-hot pressed (as-hped) and as-heat treated oxide dispersion strengthened (ODS) steel were identified in this paper using high resolution transmission electron microscopy (HRTEM) techniques. The carbon extraction replicas were utilized to investigate the composition and crystal structure of the oxide particles in order to exclude the influence of the matrix. In the as-hped ODS steel, both of the $\gamma\text{-Al}_2\text{O}_3$ and $\alpha\text{-Al}_2\text{O}_3$ particles with different size were identified, while, only the large $\alpha\text{-Al}_2\text{O}_3$ particles were found in the as-heat treated ODS steel. In addition, YAlO_3 and $\text{Y}_3\text{Al}_5\text{O}_{12}$ with body-centred cubic structure were the mainly investigated Y-Al-O particles in the as-hped ODS steel, and large amounts of $\text{Y}_4\text{Al}_2\text{O}_9$ particles with a monoclinic structure generated in the ODS steel during annealing.

Keywords: Nuclear reactor materials; Mechanical alloying; Crystal structure; Transmission electron microscopy

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