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Study of the coalescence kinetic in oxide dispersion strengthened alloys

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Compared to conventional alloys, oxide-dispersion-strengthened (ODS) ferritic alloys are promising candidate materials for the next generation of nuclear reactors (fusion and fast neutron reactors). They present excellent mechanical resistance at high temperature governed in part by the distribution of nano-oxides in the matrix. These materials are obtained by mechanical alloying and consolidated as rods by hot extrusion through a spinneret. Oxide precipitation (particles with different chemical compositions such as Y2O3, Y2Ti2O7 ⋯ may precipitate depending on the alloying elements) occurs during the hot consolidation step and during subsequent annealing at high temperature. However, the tensile or creep behavior of ODS steels varies with the oxide distribution. It is therefore of the utmost importance to control the oxide size distribution evolution during the different stages of the fabrication and during thermal treatments. With a view to understanding the mechanisms of formation and evolution of these particles, the oxides precipitation kinetics are studied as a function of nominal content of Y, Ti and O of the alloys using small-angle neutron scattering technique (SANS).
In parallel, hardness measurements and neutron diffraction in situ tests under uniaxial loading are performed in order to correlate nano-precipitation and mechanical properties.

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