Novel High-Temperature Austenitic Alloys for Energy Conversion Applications

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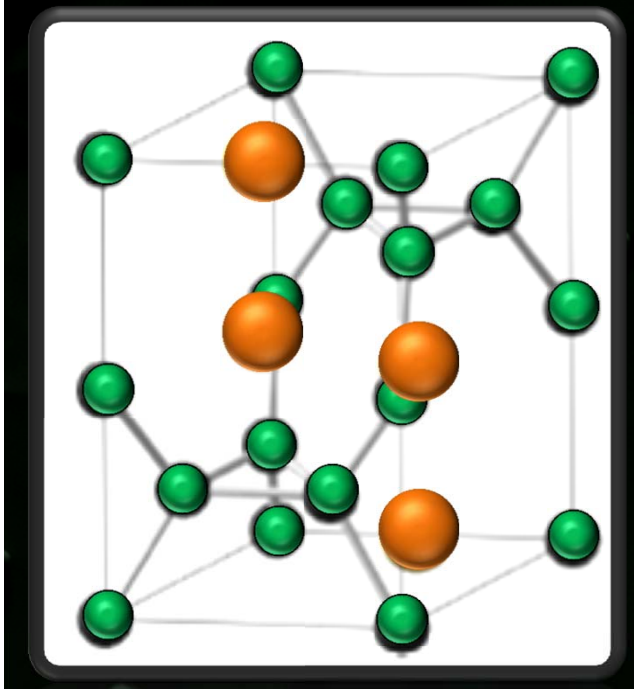
C14 Laves Phase



Fe_2Nb Laves phase precipitates have excellent thermal stability, and, thus, their use as strengtheners in high temperature stainless steels is desirable. We are attempting to enhance the creep strength of an austenitic stainless steel through refinement of the Laves phase precipitates, specifically by introducing additional nucleation sites (dislocations) via pre-straining prior to aging treatments.

A base alloy of Fe-20Cr-30Ni-2Nb-5Al (at. %) was determined to provide a suitable matrix that allows for supersaturation of the Fe_2Nb Laves phase. The microstructure of this alloy has been analyzed after a combination of thickness reductions (50% and 90%) and heat treatments (1073 K for 2.4, 24, and 240 hours). The precipitate size resulting from these treatments ranges from 110-680 nm, and coarsens with increased time at high temperature.

Next steps include extending an optimal pre-straining and heat treatment to an alloy that has silicon additions to determine whether even smaller Fe_2Nb precipitates can be obtained. The effects of the degree of cold rolling reduction on the resulting precipitate size is also being determined.

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