Statistical Analysis of Rhenium Clustering in Nickel-based Superalloys

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Rhenium additions have played an important role in improving the high temperature properties of nickel-based superalloys. Atom probe tomography and transmission electron microscopy analyses of many different rhenium containing superalloys have demonstrated that rhenium strongly partitions to the γ matrix and acts as a solid solution strengthener. Small rhenium clusters in the γ matrix have also been reported by Blavette et al. The multi-million atom, three-dimensional data sets obtained with the local electrode atom probe enable the statistical distribution of solutes in each phase to be quantified. The partitioning behavior, clustering, and ordering of rhenium and the local environment around rhenium atoms as determined from the statistical analysis of local electrode atom probe data from a CMSX4 nickel-based superalloy will be presented.

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