

Preparation of Nb Silicide-Based Alloy Powder by Hydrogenation-Dehydrogenation (HDH) Reaction

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Abstract : The Nb silicide-based alloy has the excellent high-temperature strength and relatively lower density than the Ni-based superalloy; therefore, it has been receiving a lot of attention for the next generation high-temperature material. To enhance the high temperature creep property and oxidation resistance, Si was added to the Nb-based alloy, resulting in a multi-phase microstructure with metal solid solution and silicide phase. Since the silicide phase has a low machinability due to its brittle nature, it is necessary to fabricate components using the powder metallurgy. However, powder manufacturing techniques for the alloys have not yet been developed. In this study, we tried to fabricate Nb-based alloy powder by the hydrogenation-dehydrogenation reaction. The Nb-based alloy ingot was prepared by vacuum arc melting and it was annealed in the hydrogen atmosphere for the hydrogenation. After annealing, the hydrogen concentration was increased from 0.004wt% to 1.22wt% and Nb metal phase was transformed to Nb hydride phase. The alloy after hydrogenation could be easily pulverized into powder by ball milling due to its brittleness. For dehydrogenation, the alloy powders were annealed in the vacuum atmosphere. After vacuum annealing, the hydrogen concentration was decreased to 0.003wt% and Nb hydride phase was transformed back to Nb metal phase.

Keywords : Nb alloy, Nb metal and silicide composite, powder, hydrogenation-dehydrogenation reaction

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