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Effect of Al Addition on Microstructure and Physical Properties of Fe-36Ni Invar Alloy

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Abstract : High strength Fe-36Ni-base Invar alloys containing Al contents up to 0.3 weight percent were cast into ingots and thermodynamic equilibrium during solidification has been investigated in this study. From the thermodynamic simulation using Thermo-Calc®, it has been revealed that equilibrium phases which can be formed are two kinds of MC-type precipitates, MoC, and M2C carbides. The mu phase was also expected to form by addition of aluminum. Microstructure observation revealed the coarse precipitates in the as-cast ingots, which was non-equilibrium phase and could be resolved by the successive heat treatment. With increasing Al contents up to 0.3 wt.%, tensile strength of Invar alloy increased as 1400MPa after cold rolling and thermal expansion coefficient increased significantly. Cold rolling appeared to dramatically decrease thermal expansion coefficient.

Keywords : invar alloy, aluminum, phase equilibrium, thermal expansion coefficient, microstructure, tensile properties
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