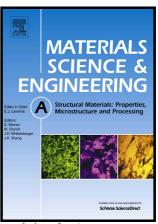
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ACCEPTED MANUSCRIPT

New generation of eutectic Al-Ni casting alloys for elevated temperature services

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Abstract

Al-Ni alloys are promising aluminum alloys for high-temperature applications

because of their many good properties partly due to the high stability of the Al₃Ni eutectic

fibers at elevated temperature. However, the matrix of eutectic Al-Ni is weak. Therefore, the

alloying elements are important not only for improving the mechanical properties but also for

preserving the stability of the fibers. Eutectic Al-Ni alloys with Sc additions are studied

through the microstructure, resultant hardness after elevated temperature exposure, high-

temperature tensile properties, fracture behavior, and TEM micrographs. The results reveal

that the addition of Sc up to 0.4 wt.% does not significantly change the grain sizes and the

morphology of the eutectic phase. However, the hardness increases with increasing amount of

Sc and remains high when the temperature reaches 300 °C, which is a result of precipitation

hardening of Al₃Sc precipitates. The hardness then decreases because of coarsening of the

precipitates. The tensile properties at high temperature of Al-6Ni alloys with Sc additions are

better than those of Al-6Ni alloy without Sc addition. This can also be explained by the

occurrence of Al₃Sc precipitates. The fracture behavior of the alloys has the same trend as the

tensile properties. Therefore, Al-6Ni-0.4Sc is a new candidate for high-temperature

engineering applications.

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