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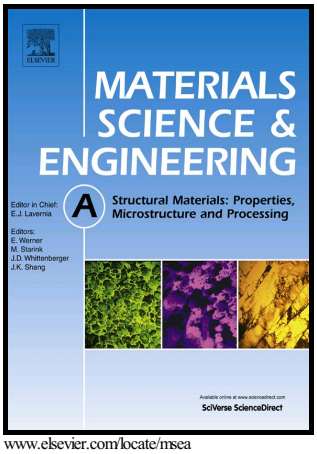

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New generation of eutectic Al-Ni casting alloys for elevated temperature services

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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 Al_3Ni 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 ºC, which is a result of precipitation hardening of Al_3Sc 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 Al_3Sc 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.