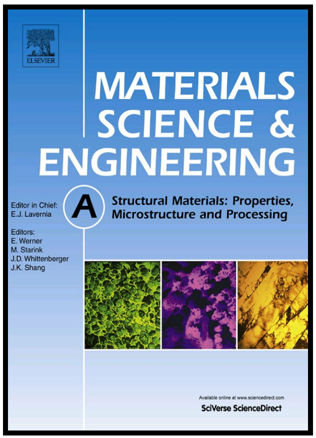

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Microstructure and thermal stability evolution behavior of Sc-containing A356.2 aluminum alloy under cyclic thermal exposure conditions

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ABSTRACT

In this work, trace amount of scandium element (Sc, 0.2 wt. %) was added to investigate microstructure and thermal stability evolution behavior of Sc-containing A356.2 alloy by using cyclic thermal exposure method. OM, SEM, TEM and image analysis software were applied to evaluate microstructure evolution. The results showed that both secondary dendrite arm spacing (SDAS) and average area of eutectic silicon increased with exposure temperature and exposure time increasing. In addition, thermal stabilities of ultimate tensile strength (UTS), yield strength (YS), elongation (EI) and micro-hardness were sensitive to cyclic thermal exposure temperatures. E.g., under 200℃ exposure temperature, more than 6 cycles were needed for the mechanical properties getting stable, and with exposure temperature of 250℃ about 4 cycles were needed. While, for exposure temperatures of 300℃ and 350℃, only 2 cycles were needed. Precipitation mechanisms of Nano Si (syn) phase and Al_3Sc phase inside of grains were discussed, and comprehensive effect of Al_3Sc, Nano Si (syn) phase, SDAS and eutectic silicon was responsible for the thermal stability of the alloy under cyclic thermal exposure conditions.

Key Words: A356.2 alloy; Cyclic thermal exposure; Scandium; Thermal stability

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