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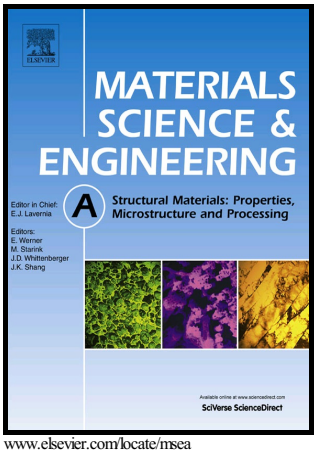

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Evolution of microstructure and mechanical properties of Al-5 wt% Ti composite fabricated by P/M and hot extrusion: effect of heat treatment

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Abstract

An Al-5 wt% Ti composite was fabricated via powder metallurgy and hot extrusion from initial pure Al and Ti powders. The effect of subsequent heat treatment at 600 ^{o}C for different time intervals on microstructure and mechanical properties was investigated. XRD and EDS analyses showed the in-situ formation of Al_3Ti intermetallic. SEM micrographs demonstrated the formation of core-shell structured particles in Al matrix for composites heat treated up to moderate heating times (4 hours). Generation of voids and pores in the heat treated composites was considered as a result of the Kirkendall effect. Mechanical properties of composites were studied by hardness and tensile testing methods at room temperature. By increasing heating times up to 6 hours, hardness and tensile strength of the composites increased due to the rise in Al_3Ti volume fraction. Heat treating more than 6 hours resulted in reduction of both hardness and strength of the composite. Ductility of Al-5 wt% Ti composites declined with increasing thermal exposure duration. SEM imaging was used to study fracture surface of tensile test specimens. It was revealed that failure mechanism of composites changed from particle fracture in moderate heating times, to particle debonding and particle pull-out in long heat treatment time intervals.

Keywords: In-situ Al/Al_3Ti composite, Core-shell structure, Powder metallurgy, Hot extrusion