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Hardness measurements in three-layer Al/SiC_p composites

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Abstract

Different characterization techniques must be used to assess the behavior of multiple-layer MMC's. Simple hardness measurements in three-layer Al/SiCp composites are a convenient means for defining of sandwich structure (SS) and functionally graded (FG) composites. Three-layer composites were prepared by the non-assisted infiltration of plate-shaped SiCp porous preforms by an experimental Al-Si-Mg alloy. The sandwich structure type and graded plate composites were characterized by X-ray diffraction (XRD) and scanning electron microcopy (SEM) in addition to hardness tests, which ultimately depict the SS and FG nature of the composites. The results show that by a suitable selection of the processing parameters it is possible to produce SS and FG Al/SiCp composites via pressureless infiltration.

Key words: *Behavior of multiple-layer MMC, Hardness measurements, Three-layer Alsicp composites, Sandwich struture, Pressureless infiltration*

1. Introduction

To date the pressureless infiltration method has been used mostly for the preparation of monolithic Al/SiCp composites, with a single particle size distribution of reinforcements and ceramic volume fraction. Only a few works regarding the use of layers have been published (Parras-Medécigo *et al.*, 2002; Aguilar-Martínez *et al.*, 2004). And due to its capillarity dependent nature, the challenge has often been to achieve a full wetting of the solid reinforcements by the liquid metal (Pech-Canul *et al.*, 2000; Pech-Canul *et al.*, 2000). It can readily be recognized that when there exists an interface formed by two preforms with different characteristics (vol. fraction of reinforcements or porosity, particle size, thickness, etc.) the capillary conditions change from one to another and different degrees of infiltration can be obtained. The difficulty increases, moreover, when more than two preforms are piled up. The failure is manifested typically by the presence of porosity, which can be classed in alloy matrix porosity and lack of filling, observed as inter-particle holes. Essentially the problem lies on the changes in capillary pressure – usually denoted as $\triangle P$–caused by the differences in preform characteristics. Therefore, if it is wanted to infiltrate the preform assembly in one-

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