

Abstract ID-174

## MICROSTRUCTURE AND MECHANICAL PROPERTIES OF Al-6061/TiC METAL MATRIX COMPOSITES

Reynaldo Morales Hernandez<sup>(1)</sup>, Victor Hugo Lopez Morelos<sup>(1)</sup>, Andrew Kennedy<sup>(2)</sup>, Jorge Alejandro Verduzco Martinez<sup>(1)</sup>, Rafael Garcia Hernandez<sup>(1)</sup>, Egberto Bedolla Becerril<sup>(1)</sup>

<sup>(1)</sup>Instituto de Investigaciones Metalúrgicas - UMSNH, Mexico

*reymo\_18@hotmail.com, composito@yahoo.com, verduzco@umich.mx, rgarcia@umich.mx, ebedolla@umich.mx*

<sup>(2)</sup>University of Nottingham, United Kingdom

*andrewkennedy@notts.uk*

**Keywords:** metal matrix composites, TiC, Infiltration, Microstructure, Flux, Mechanical strength

**Summary:** In this study, manufacturing of Al-6061 matrix composites reinforced with 6 and 12% vol. of TiC particles was carried out by incorporating and diluting an Al/TiC/40p master composite. The composites were microstructurally and mechanically characterized in order to assess the effects of adding TiC particles into the Al-6061-T6 matrix. The master composite was fabricated by a flux assisted infiltration process. Powders of TiC (16.1  $\mu\text{m}$ ) and K-Al-F based flux (18.3  $\mu\text{m}$ ) were mixed in a 3:1 mass ratio. This mixture was uniaxially pressed and infiltrated with aluminium of commercial purity at 800°C and held at temperature for 30 minutes under flowing Ar. The microstructural characterization revealed that the green compacts were fully infiltrated, however, a mass fraction of the flux was trapped within the matrix and the presence of Al<sub>3</sub>Ti needles was observed. The fabricated Al/TiC/40p master composite was added into a molten Al-6061 alloy, targeting a reinforcement content of 6 and 12% vol. of TiC particles, at 750°C for holding times of 10 and 18 minutes, respectively. The incorporation and dispersion of the TiC particles was successful and by using image analysis a yield of 93.4% and 89% for the Al-6061/TiC/6p and Al-6061/TiC/12p composites, respectively, was estimated. Moreover, the microstructural characterization showed a quite even distribution of the TiC particles with few clusters and free of reaction products for the Al-6061/TiC/6p composite. The microstructure of the Al-6061/TiC/12p samples also exhibited good distribution of the particles but with a larger number of particles agglomerated and with the presence of acicular Al<sub>3</sub>Ti intermetallics. For both contents of reinforcement, the presence of entrapped flux was observed within the matrix, for the Al-6061/TiC/12p composite, these occurrence was more evident. In the other hand, the monolithic alloy and the composites were subjected to a hot rolled process and subsequently to a T6 heat treatment. With respect to the Al-6061-T6 alloy, the composites exhibited a lower tensile strength but a larger elastic modulus. Fractography in the scanning electron microscope indicated that this behavior is due to the presence of flux in the matrix.