POLITECHNIKA ŚLĄSKA W GLIWICACH
Wydział Mechaniczny Technologiczny

mgr inż. Łukasz Krzemiński

PRACA DOKTORSKA

Struktura i własności biomorficznych materiałów kompozytowych Al/C; Al/TiO/C; Al/TiC/C wzmacnianych karbonizatem węglowym, wytwarzanych technologią infiltracji ciśnieniowej

PROMOTOR

dr hab. inż. Tomasz Tański prof. Pol. Śl.

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Abstract

The purpose of this PhD thesis was to produce biomorphic composite materials and to study their structure and properties. In the first stage of the experiment, porous pine carbon chars were obtained, which were then subjected to surface modification using ALD and sol-gel methods. For sol-gel carbon chars, a carbothermal reduction was applied to obtain a porous carbon preforms filled with TiC. In the next step, unmodified carbon chars and also surface-modified ALD and sol-gel carbon chars with subsequent TiC phase synthesis were subjected to structural and phase analyzing. A further part of the experiment consists of pressure infiltration with AlSi12 alloy of three previously obtained carbon char groups. As a result, biomorphic composites on the light alloy matrix were obtained, which were subsequently subjected to a number of structural, morphological, phase and spectral analyzes, as well as hardness, abrasive wear and compressive strength tests. The results of structural tests confirmed the crystallization of Al4C3 phases in the structure in unmodified and TiC carbon char reinforcement. It has also been confirmed that in the biomorphic structure reinforced with ALD carbon char, not contain carbides phases. It was also found that the presence of hard carbides phases in the structure of biomorphic composites improves their mechanical properties, in comparison to the mechanical properties of the matrix material. This causes decreasing of mechanical propertes of ALD biomorphic materails compared to mechanical properties of carbides filled composites. The reason for this state is probably appearance of thin TiO_2 layer deposited on the reinforcement of the ALD biomorphic composite. The thin ALD layer significantly prevents the reaction between the carbon phase and the liquid metal during pressure infiltration with AlSi12 alloy.