11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Pre-Placed Laser Cladding of $Al_{92}Fe_3Cr_2Mn_3$ quasicrystals former alloy on 7021 aluminum alloy

P. Gargarella[(1)*], R. Vilar[(2)], C. S. Kiminami[(3)], C.T. Rios[(3)], W. J. Botta[(3)] and C. Bolfarini[(3)]

(1) Programa de Pós-graduação em Ciência e Engenharia de Materiais, Universidade Federal de São Carlos, Rodovia Washington Luiz, Km 235, 13565-905, São Carlos, SP, Brazil, piterg@gmail.com

(2) Departamento de Engenharia de Materiais, IST-UTL, Av. Rovisco Pais, 1049-001, Lisbon, Portugal, rui.vilar@ist.utl.pt

(3) Departamento de Engenharia de Materiais, Universidade Federal de São Carlos, Rodovia Washington Luiz, Km 235, 13565-905, São Carlos, SP, Brazil, Kiminami@power.ufscar.br, triveno@ufmt.br, wjbotta@ufscar.br, cbolfa@power.ufscar.br

* Corresponding author.

In the present work, coating of the quasicrystalline phase-forming $Al_{92}Fe_3Cr_2Mn_3$ alloy was produced by pre-placed laser cladding on substrate of 7021 aluminum alloy. A 2 kW CW Nd:YAG laser was used to produce the coating with a gas-atomized $Al_{92}Fe_3Cr_2Mn_3$ powder. The coating was characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM) and a thermal analysis was carried out by differential scanning calorimetry (DSC). The formation of quasicrystalline icosahedral phases in the coating and the latter's thermal stability up to 467°C were confirmed by XRD and DSC. The microstructure of the coating presented aggregates with a five-arm star morphology and a quasicrystalline phase at its center, and had a composition of $Al_{82,5}Fe_{5,8}Cr_{7,5}Mn_{3,6}Zn_{0,6}$. The coating hardness increases with depth to reach a maximum value of 163 HV near the substrate/coating interface. These results demonstrate the possibility of producing a coating with quasicrystalline phases on ordinary aluminum alloy substrates, with the following benefits provided by the presence of the metastable phase; high hardness and stiffness allied to low fracture toughness, low electrical and thermal conductivities, and low friction coefficients.