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FUNCTIONAL SURFACES VIA LASER PROCESSING IN LIQUID MEDIA

A. Pascu[1], E.M. Stanciu[1], C. Croitoru[1], I.C. Roata[1], M.H. Tierean[1], I. Hulka[2], J.C. Mirza Rosca[3]

[1] *Transilvania University of Brasov, Materials Engineering and Welding Department, 29 Eroilor Blvd., 500036, Brasov, Romania, e-mail: alexandru.pascu@unitbv.ro*
[2]*Research institute of renewable energy – ICER, "Politehnica" University of Timisoara, ROMANIA*
[3]*Las Palmas de Gran Canaria University, SPAIN*

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Abstract: Nowadays the laser technology has become an important means for materials processing, such us heat treatments, coatings, micro-processing, superficial alloying. Besides the conventional methods of depositions, laser technology can be successfully used for micro-processing and/or microalloying of metallic surfaces. The present research addresses to an innovative method of surface enhancement by laser processing into a liquid media. In a recent study Xiangru Feng [1] reports good results by adding titanium and applying Zn coating to nickel aluminum bronze substrate in an underwater laser cladding set-up. The tests reveal improved corrosion resistance and a refinement of the coating microstructure. In a complementary study Xiangru Feng [2] investigates the interactions between laser, water and substrate and highlights the benefits of Titanium addition.
A pulsed laser TRUMPH 525 together with an CLOOS seven axes robot has been used for underwater micro-processing of low carbon steel specimens (4 mm thickness). The novelty of the present research resides in addition of nickel salts into the liquid media for surface microalloying. The laser parameters and the liquid level was varied during the experimental trials in order to identify the optimal process parameters.
The laser micro-processed surface was analyzed by optical and electronic microscopy and the alloying was determined by EDS and XRD analysis. The mechanical proprieties have been determined by microhardness testing and by scratch tests. No heat affected zone was identified on the laser processed samples and no microstructural changes was observed. The results show an enhancement of mechanical behavior as well as an increasing of corrosion resistance.

Selective references:

1. X. Feng, X. Cui, et.al, *Performance of underwater laser cladded nickel aluminum bronze by applying zinc protective layer and titanium additives*, Journal of Materials Processing Technology 266, 2019, p. 544-550
2. X. Feng, X. Cui, et.al, *Effect of the protective materials and water on the repairing quality of nickel aluminum bronze during underwater wet laser repairing*, Optics & Laser Technology 114, 2019, p. 140-145

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