PhD in Materials Science and Technology

Research Title: Corrosion behavior of metal alloys processed by additive manufacturing

Funded by	Politecnico di Torino

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Contact	http://www.disat.polito.it/research/research_groups/musychen/materials_environment_interaction http://www.disat.polito.it/research/research_groups/simti/materials_for_high_temperatures_and_nanocomposites

Context of the research activity	**Context of the research** In recent years additive manufacturing (AM) techniques attracted increasing interest as innovative way for processing metallic alloys. The manufactures processed according this technology show peculiar characteristic in terms of microstructure (e.g. porosity and residual stresses). These particular microstructure features affect all the properties of the material: mechanical, physical and chemical behavior. For this reason the performance of materials resulting from additive manufacturing process should be better. investigated. **Activity** The activity will be mainly focused on the corrosion behavior of different kinds of alloys whose additive manufacturing has been developed during the last years (e.g. steels, aluminium alloys, titanium alloys, intermetallics alloys etc.). Their corrosion resistance will be investigated by means of electrochemical tetst (polarization curves, electrochemical impedence measurements, recorded under different aggressive environments checked to simulate most common operating conditions) coupled with microstructure

	and chemical materials modifications. To this last purpose several experimental techniques will be exploited: metallography, electron microscopy, X-ray diffraction, microanalysis (EDS,XPS), hardness measurement etc.

Objectives	The main objective of the research can be listed as in the following: 1. To compare, when possible, the corrosion behavior of samples processed by additive methods to those of the same material obtained by conventional methods. 2. To investigate the relationship between microstructural features resulting from AM and corrosion resistance. 3. To investigate the relationship between microstructural features resulting from AM and corrosion mechanism. 4. To put in evidence possible critical aspects of corrosion behavior in relation to envisaged practical applications of the materials studied.

Skills and competencies for the development of the activity	The candidate should have good knowledge in the field of Materials Engineering, some previous experience in laboratory activity and previous experience in the use of some characterization techniques as (for instance) metallography, microscopy, X-ray diffraction, hardness test etc.