

Giovanni Pulci CV

Giovanni Pulci is an Associate Professor in Materials Science and Technology at the Dept. of Chemical Engineering, Materials, Environment (DICMA) of Sapienza University of Rome.

His research has been focused since 2004 on the fields of surface engineering and thermal protection systems, and specifically on thermal sprayed and electroless coatings (for wear, oxidation and corrosion resistance) and materials for high temperature applications (ablative thermal protections and thermal barrier coatings).

The main interests concern the following research fields:

1) Surface engineering

- Development of innovative coatings produced by Plasma Spray, High Velocity Oxygen Fuel (HVOF) and Cold Gas Spray techniques, also aiming at producing nanostructured and nanocomposite coatings.
- Development and deposition of innovative diffusion NiAl based coatings obtained by slurry and pack cementation and modified by reactive elements and nanoparticles.
- Development and characterization of conventional and nanostructured Thermal Barrier Coatings (TBCs) deposited by Atmospheric Plasma Spraying (APS) and Suspension Plasma Spraying (SPS).
- Development and characterization of innovative MCrAlY coatings deposited by thermal spray techniques and modified by reactive elements and by vapour phase surface modification treatments.
- FEM modelling of the thermo-mechanical behaviour of TBC systems in terms of thermal cycling properties and effects induced by the oxide scale growth at high temperature.
- Optimization of the process parameters of the deposition and surface modification technologies: the developed coatings are optimized to operate at high temperature, in corrosive and oxidizing environments and in anti-wear applications.
- Microstructural, mechanical, tribological and corrosion/oxidation resistance characterization of coatings, films and modified surfaces.
- Development of innovative coatings deposited by electroless plating techniques (e.g. pure metals such as Ni or Co, alloys such as Ni-P, Ni-Co or Ni-Co-Cr and metal matrix nanocomposite films).
- Characterization and modification of surface wetting properties.

2) Nanostructured materials:

- Production of nanostructured coatings and bulk materials (thermal barrier coatings, cermet coatings, ceramic composites).
- Evaluation of the effects of nanostructure on mechanical, thermal and thermomechanical (e.g. thermal shock resistance) properties.

3) *Composite and nanocomposite materials for high temperature applications:*

- Development and manufacturing of composite and nanocomposite ablative materials to be used as thermal protection systems for rockets and aerospace re-entry vehicles.
- Surface functionalization of nanoparticles and optimization of nanofillers dispersion in polymer matrices.
- Qualification and testing (also in external facilities) of the developed ablative materials in representative high enthalpy conditions (oxyacetylene torch test, arc-jet plasma wind tunnel, ICP plasma wind tunnel). Technology Readiness Level (TRL): 5-6.
- FEM modelling of the thermal behaviour of ablative materials (in terms of recession/ablation, thermal field, pyrolysis phenomena, thermochemical interactions at boundary layer).

4) *Advanced mechanical characterization:*

- Development and optimization of testing procedures for mechanical characterization of materials in non-standard conditions (e.g. low and very high temperatures, from -190 to 1500 °C).
- Analysis of materials behaviour at micro/nanoscale by instrumented (dynamic) micro/nanoindentation.

5) *Performance evaluation of materials:*

- Characterization of bulk materials, coatings and components in severe environments reproducing the real operating conditions (wear tests, high temperature oxidation tests, hot corrosion tests, high temperature/high heat flux ablation tests).

He has been scientific leader (principal investigator) in several research projects such as:

- Industrial research project “Thermal cycling characterization of Thermal Barrier Coatings (TBC) systems” funded by Nuovo Pignone Tecnologie Srl, 2020 (principal investigator).
- Industrial research project “Machining of ultra-hard materials by laser ablation” funded by PaSe Srl. 2018-2020 (principal investigator)
- Industrial research project “Development and characterization of electroless Nickel coatings” funded by Baker Hughes BHGE - a GE Company. 2017-2020 (principal investigator)
- Industrial research project “MO.N.S.T.E.R. (Modified Ni-based Surface Treatments for Enhanced Resistance)” funded by GE Oil&Gas. 2016-2017 (principal investigator).
- “Development and characterization of thick coatings for anti-wear/corrosion applications in wind turbine generators” funded by RINA group in the framework of EOMAT Project Bando PON R&C. 2015-2016 (principal investigator).

- Industrial R&D activities funded by WARTSILA (marine engines) on development of Plasma Transferred Arc self-lubricating coatings for valve seats 2015 (principal investigator)
- Research project “Nanocoat – Thin films deposition for enhanced corrosion resistance” funded by the Region of Friuli Venezia Giulia. 2011 (principal investigator).

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He is in charge of the following courses within the Master of Science in Nanotechnology Engineering at Sapienza University of Rome:

- Course of “Surface Engineering” (since 2018, language: ENG)
- Course of “Production and characterization of nanocomposite materials - coatings” (since 2018, language: ITA)
- Course of “Nanostructured materials” (since 2012, language: ITA)