Oxidation of Cold Sprayed Particles

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Abstract

Introduction
The quality of obtained coatings in thermal spraying methods depends strongly on oxygen content in the powder. This is also the case of cold spray. Although during the impact of particles into the substrate, part of the oxide layer is removed but the reminder part stays in the coating what affects negatively the properties like i.e. electrical conductivity or adhesion. Due to the fact that the powder particle remains in the nozzle only about 0.01s, the FEM method seems to be suitable to observe oxidation process e.g COMSOL Multiphysics® software has been successfully used for tracking the phenomena of oxidation[1,2].

Use of COMSOL Multiphysics®
A time dependent multiphysics model of the oxidation of the sprayed particle will be developed and assessed. It will be implemented using Level Set Method. The data from the previous simulation in MATLAB® including the temperature and the duration of the process will be uploaded and used as boundary conditions. The model will be verified through oxidation data available in the literature.

Results
The aim of the work will be investigation of oxidation behaviour of titanium particles during cold spray process. This will allow to get the answer the degree of oxidation and hence how much of the built oxide layer is really removed during the particle impact. It will also be possible to assess the influence of temperature of the spraying process. The distribution of the temperature and velocity of the particles in the nozzle is already known from previous simulations.

Conclusion
The model will help to deepen knowledge of the phenomena occurring during cold spraying, and possibility of applying COMSOL Multiphysics® to research of oxidation during thermal spraying processes.

Reference

1. Davidy A., Numerical Modeling of Falling Aluminium Particle Oxidation in Air, Proceedings of the COMSOL Conference, Boston 2010
2. Auge A., Oxidation of Metallic Nanoparticles,Proceedings of the COMSOL Conference, Milan 2009.