Creation of Graded Microstructures by Thermal Nanoparticles Spraying

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Abstract

Thermal nanoparticles spraying were newly developed to create fine metals or ceramics layers with graded structure rapidly. The nanometer sized ceramics particles were dispersed into liquid resins at about half volume fraction, and the obtained high viscosity slurry was blown as micro mists into an acetylene gas flame spray. Microstructures were observed by using scanning electron microscopy. X-diffraction spectroscopy was used to analyze the residual carbon elements produced by imperfect combustions of the liquid resin. Effective dielectric constants of the ceramics layers were measured successfully to calculate the porosities of air defects volume contents by using time domain spectroscopy of electromagnetic waves in a terahertz frequency range. The modulations of microstructural gradations through the spraying parameters control will be discussed.

Keywords: thermal nanoparticles spraying, acetylene gas flame, slurry materials, graded microstructures, terahertz wave measurement, graded structure modulation.