Peng-Sheng Wei, J Nanomed Nanotechnol 2017, 8:5 (Suppl)
DOI: 10.4172/2157-7439-C1-052

The effects of wave characteristics on energy generation during additive manufacturing

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A systematical investigation of energy generation responsible for heating and melting during selective laser melting or selective laser sintering in additive manufacturing with a pulsed laser is studied. A surface Plasmon on a rough or grating metal surface can be excited by an incident laser beam in a TM mode. The surface plasma wave is an electromagnetic wave that propagates at the boundary between two media, leading to a concentrated and distributed energy generation on the surface. In this study, energy generated is composed of resistive, dielectric and magnetic losses. Distributions of different modes of energy generated for different frequencies and widths of laser beam irradiating on particles on a surface are presented. Heating and melting during additive manufacturing are, therefore, revealed. Figure-1 shows high energy generation or divergence of Poynting vector occurs near the peak and surface of particles on a surface for different radii of incident electromagnetic wave. Electrical field propagates in radial directions while energy generation decreases, provided that the radius of incident electromagnetic wave decreases.

Recent Publications

1.Wei P S, Hsiao S Y (2016) Effects of mass transfer coefficient on pore shape in solid. *International Journal of Heat and Mass Transfer*; 103: 931-939.

2.Wei P S, Hsiao S Y (2016) Effects of solute concentration in liquid on pore shape in solid. *International Journal of Heat and Mass Transfer;* 103: 920-930.

Biography

Peng-Sheng Wei has received his PhD in Mechanical Engineering Department from University of California, Davis. He has been a Professor in the Department of Mechanical and Electro-Mechanical Engineering of National Sun Yat-sen University, Taiwan. He has contributed in advancing the understanding of and to the applications of electron and laser beam, plasma and resistance welding through theoretical analyses coupled with verification experiments. He has published more than 80 SCI journal papers. He has been the Xi-Wan Chair Professor of NSYSU and Invited Distinguished Professor in the Beijing University of Technology, China.

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