



Direct Fabrication of Ceramic Components by Ultraviolet Laser Lithography

Soshu Kirihara

Joining and Welding Research Institute, Osaka University, Japan

Abstract:

Ultraviolet laser lithography was newly developed as a direct forming process of fine ceramic components with micro geometric patterns. As additive manufacturing techniques, two dimensional cross sections were created through dewaxing and sintering by UV laser drawing on spread resin paste including ceramic nanoparticles, and three dimensional composite models were sterically printed by layer laminations and interlayer joining. Alumina particles of 300 nm in average diameter were dispersed in to photo sensitive liquid resins at 50 % in volume fraction. The resin paste was spread on a glass substrate at 50 μm in layer thickness by a mechanically moved knife edge. An ultraviolet laser beam of 355 nm in wavelength was adjusted at 10 μm in diameter and scanned on the surface. Irradiation power was increased to 1.0 W for enough solidification depth. The half wavelength of the incident ultraviolet ray should be comparable with the nanoparticles gaps in the resin paste, and electromagnetic field can be resonated and concentrated through Anderson localization. In this investigation, through computer aided smart manufacturing, design and evaluation (Smart MADE), fluctuated patterns were introduced into inner walls of micro tubes to modulate liquid and gaseous flows effectively.

Biography:

Soshu Kirihara is a doctor of engineering and a professor of Joining and Welding Research Institute (JWRI), Osaka University, Japan. In his main investigation "Materials Tectonics" for environmental improvements of "Geotechnology", multi-dimensional structures were successfully fabricated to modulate energy and materials flows effectively. Ceramic and metal components were fabricated directly by smart additive manufacturing, design and evaluation (Smart MADE) using high power ultraviolet laser lithography. Original stereolithography systems were developed, and new start-up company "SK-Fine" was established through academic-industrial collaboration.



Recent Publications:

1. Three-dimensional microphotonic crystals of ZrO₂ toughened Al₂O₃ for terahertz wave applications, W. Chen, S. Kirihara, Y. Miyamoto, *Applied Physics Letters*, 91 (2007) 153507-1-1535073.
2. Analysis of Electromagnetic Response of 3-D Dielectric Fractals of Menger Sponge Type, E. Semouchkina, Y. Miyamoto, S. Kirihara, G. Semouchkina, M. Lanagan, *IEEE Transactions on Microwave Theory and Techniques*, 55(6) (2007) 1305-1313.
3. Fabrication of three-dimensional ceramic photonic crystals and their electromagnetic properties, H. Mori, S. Kirihara, M. W. Takeda, K. Sakoda, Y. Miyamoto, *Journal of European Ceramic Society*, 26 (2006) 2195-2198.
4. Strong Localization of Microwave in Photonic Fractals with Menger-sponge Structure, S. Kirihara, M. W. Takeda, K. Sakoda, K. Honda, Y. Miyamoto, *Journal of European Ceramic Society*, 26(10-11) (2006) 1861-1864.
5. Microwave Absorption in Photonic Crystals Composed of SiC/Resin with a Diamond Structure, Z. Liu, S. Kirihara, Y. Miyamoto, D. Zhang, *Journal of the American Ceramic Society*, 89(8) (2006) 2492-2495.

15th International Conference on Laser Advanced Materials Processing , June 22-23, 2020, Osaka, Japan

Citation: Soshu Kirihara: Direct Fabrication of Ceramic Components by Ultraviolet Laser Lithography June 22-23, 2020, Osaka, Japan