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Bioligical Implant Fabrications with Fuructuated and Graded Dimensions by Stereolithogarphic Additive Manufacturing

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In stereolithographic additive manufacturing (STL-AM), 2D cross sectional patterns were created through photo polymerization by ultra violet laser drawing on spread resin paste including ceramic nanoparticles, and 3D composite models were sterically printed by layer lamination though chemical bonding. The stereolithography system has been developed to obtain bulky ceramic and metal components with functionally geometric structures. An automatic collimeter was newly equipped with the laser scanner to adjust beam diameter. Fine or coarse beams could realize high resolution or wide area drawings, respectively. Nanometer sized ceramic particles were dispersed in to photo sensitive liquid resins from 40 to 60 % in volume fraction. The paste was spread on a glass substrate at 10 μm in layer thickness. An ultraviolet laser beam of 355 nm in wavelength was adjusted from 10 to 300 μm in variable diameter and scanned on the pasted resin surface. Irradiation power was changed automatically from 10 to 200 mW. The created precursor was dewaxed and sintered in an air atmosphere to obtain full metal or ceramic components. Subsequently, ultraviolet laser lithography was newly developed. 2D cross sections were created through dewaxing and sintering by UV laser drawing on spread resin paste including ceramic nanoparticles, and 3D composite models were sterically printed by layer laminations. Irradiation power was changed automatically from 1.0 to 1.2 W for enough solidification depth for 2D layer bonding. The half wavelength of the incident ultraviolet ray should be comparable with the nanoparticles gaps in the resin paste, therefore the dewaxing and sintering will be realized through the electromagnetic waves resonations and localizations. Through the smart additive manufacture, design and evaluation (Smart MADE), bioceramic implants of dental crowns were fabricated successfully.

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.