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Discrete element simulation on the ordered array of carbon fiber with ultrasonic vibration assisting in SLS

Yuanqiang Tan[1] and **Jufang Liu**[2]
[1]Huaqiao University, China
[2]Xiangtan University, China

Carbon fiber enforced Nylon materials is a developing technology in selective laser sintering (SLS) process. The strength of the sintering components will increase with ordered array carbon fiber. An ultrasonic vibration assisted directional arrangement method for carbon fiber in powders is proposed. The powder bed model including short carbon fiber and nylon particles with a defined radius distribution, was simulated by discrete element method. The ultrasonic vibration was inserted to the powder bed. The fiber orientation frequency and orientation probability entropy are taken as criteria to evaluate the variation degree of orientation and ordering of carbon fiber. Three process factors, such as ultrasonic vibration amplitude, frequency and vibration time which affect the orientation arrangement of fiber were investigated. The results indicate that, with applying of ultrasonic vibration on the powder bed, the fiber orientation frequency along the vibration direction increased significantly. Moreover, as the vibration amplitude increasing, the degree of fiber orientation changes from high to low. With the enhancement of frequency, the change in the degree of fiber orientation gradually improves, and the ordering increases obviously. The vibration time effect exerting on the degree of fiber orientation and fiber ordering is consistent with the effect of vibration frequency. The authors acknowledge the financial support from NSFC (11752135)

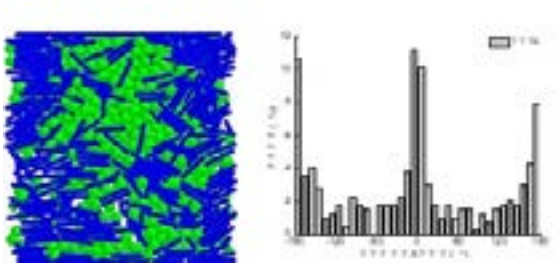

Fig 1 Carbon fiber distribution with US vibration assisted

Biography

Yuanqiang Tan has completed his PhD from Central South University of China. He is a professor of the Institute of Manufacturing Engineering of Huaqiao University, a premier research organization of China. He has published more than 50 papers in reputed journals and has been serving as an reviewer of repute journals.

tanyq@hqu.edu.cn

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