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微米级球形金属粉体的稳定脉冲微输送

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Stable pulse micro-feeding of micron spherical metal fine powder

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摘要 图/表 参考文献 相关文章 (12)

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摘要 针对激光熔覆或3D微打印等金属零件先进制造技术对稳定微量输送金属粉体的要求,分析了微米尺度金属粉体脉冲输送机理.为提高金属粉体脉冲输送分辨率和输送稳定性,设计了余弦修圆波形、正弦修圆波形和正弦余弦组合修圆波形作为压电致动器的驱动电压波形.对平均粒径为100 μm的均匀球形TC4钛合金粉体进行了脉冲微输送实验.实验结果表明:余弦修圆波形使粉体做"前进"运动,正弦修圆波形使粉体做"后退"运动;分散态粉体单颗稳定输送达粉体总量的90%,密集态粉体脉冲微输送过程中密实度可控,粉体微输送过程稳定,无结拱现象发生.本文的研究结果也可为其它微米尺度材料或其他形状粉体的脉冲微输送提供参考.

关键词 : 激光熔覆, 金属微粉体, 微输送, 脉冲惯性力, 微喷嘴

Abstract : For the requirements of stable micro-feeding of micron metal powder in advanced metal part manufacturing technology including laser cladding and 3D micro-printing, the pulse micro-feeding mechanism of micron spherical metal fine powder was researched. To improve the resolution and stability of metal powder micro-feeding, three driving voltage waveforms, including cosine-shape rounded wave, sine-shape rounded wave and sine-cosine integrated rounded wave, were designed as the driving voltages of the piezoelectric actuator. A pulse micro-feeding experiment for the uniform spherical TC4 titanium alloy powder with an average diameter of 100 μm was performed. The experiment result show that the cosine-shape rounded wave makes the powder go forward while the sine-shape rounded wave makes the powder go back. The percentage of the dispersing state powder transported one by one has reached 90%. The powder degree of compaction can be controlled. The powder micro-feeding process is stable without the phenomenon of powder arch accumulation. The obtained results provide references for the micro-feeding of other kinds of powder with different materials and different shapes.

Key words : laser cladding deposition metal fine powder micro-feeding pulse inertia force micro-nozzle

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