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微纳技术与精密机械

数字化微喷射用玻璃基组合微喷嘴设计及实验

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摘要： 为提高液滴微喷射的喷射效率和粉体微喷射的喷射方向性,选用普通硼硅酸盐毛细管和石英玻璃管为原材料,基于稳定的拉制和锻制工艺,设计并制作了直列式组合微喷嘴和同轴式组合微喷嘴。在基于微流体数字化的微喷射实验平台上,利用4×2直列式组合微喷嘴单次喷射得到了形状规则、圆整,大小均匀,无卫星液滴的液滴阵列,液滴平均直径为180 μm;相对于单微喷嘴,直列式组合微喷嘴提高了单次微喷射的效率。另外,进行了粉体微喷射实验,相对于单微喷嘴,同轴式组合微喷嘴在相同驱动条件下,出射角由33° 减小至10° ,成形粉线的宽度由450 μm降低至300 μm。结果表明,同轴式组合微喷嘴中的辅助喷嘴有效地约束了主喷嘴出射的粉体流动,粉体喷射的方向性有显著提高。

关键词： 微流体数字化 微喷射 玻璃基 组合微喷嘴

Design and experiment of vitreous combined micro nozzles used in digital micro injection

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Abstract: In order to improve the injection efficiency of liquid micro injection and the injection directivity of powder micro injection, a borosilicate capillary and a quartz glass tube are chosen as raw materials to design and manufacture the in-line combined micro nozzle and the coaxial combined micro nozzle based on stable drawing and forging process. Using these tow combined micro nozzles, liquid and powder micro injection experiments are performed on a micro injection experiment system based on the digitalization of microfluidic technology. In liquid micro injection experiment, the regular and uniform droplet array with a average diameter of 180 μm and no satellite droplets is prepared with one injection in a 4×2 in-line combined micro nozzle, by which the efficiency of micro injection under in-line combined micro nozzle is improved as compared with that of single micro nozzle. In powder micro injection experiment, the injection angle is reduced from 33° to 10° and the width of formed powder line is decreased from 450 μm to 300 μm as compared with that of single micro nozzle. The results indicate that the powder flow of the major micro nozzle in coaxial combined micro nozzle is constrained with the assisted micro nozzle and the injection directivity is improved greatly.

Keywords: digitalization of microfluidic micro injection vitreous combined micro nozzle

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