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Direct fabrication of metal tubes with high-quality inner surfaces via droplet deposition over soluble cores

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Abstract:

Droplet-based 3D printing is very promising for the fabrication of complex thin-wall microwave devices such as antenna horns and waveguide tubes since it can print a shell by utilizing only several layers of droplets. However, due to the naturally scalloped shape of metal droplets, conventional droplet-based 3D printing methods cannot produce thin-wall tubes with high-quality inner surfaces that can meet the requirement of electromagnetic transmission. Here, combining the conventional casting procedure and droplet printing, a hybrid printing process is proposed. Uniform aluminum droplets were first rotationally deposited on a soluble core, and then the core was dissolved and left behind a tube with a high-quality inner surface. The deposition parameters (i.e., number of layers and deposition frequency) were adjusted according to the rotation of the core to form a dense shell over its surface. A hexagonal metal tube was fabricated