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Characterization of Aerosol Printed Silver Traces on Silicone

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Aerosol jet printing (AJP) is a direct write technology that has emerged as a promising method for microelectronic circuit fabrication capable of high resolution traces printed across three-dimensional surfaces. Applications for flexible circuits vary and in this work the focus was on the production of high-density interconnection circuits for implantable devices printed on molded silicone substrates. AJP requires control of numerous printing parameters, such as the sheath gas flow rate, carrier gas flow rate, number of printed layers, and sintering temperature. This work characterizes the effects of the gas flow rate focusing ratio (FR), number of printed layers, and sintering temperature on printed silver trace geometry and particle morphology. The FR, defined as the ratio of sheath gas flow to carrier gas flow, was varied from 4 to 10 by increasing the sheath gas flow while maintaining a constant carrier gas flow [1]. The number of printed layers were varied with each focus ratio, and the sintering temperature ranged from 150°C to 200°C. Substrate surface roughness and line geometry were characterized using optical profilometry. Qualitative analyses of the trace character (i.e. overspray, cracking) was performed with optical microscopy while ink particle morphology was assessed using scanning electron microscopy. Results were analyzed and used to optimize the traces and create processing recommendations for ink/substrate combinations [2].

References:

[1] PV Arsenov, AA Efimov, and VV Ivanov. Key Engineering Materials **779** (2018), p. 159. https://doi.org/10.4028/www.scientific.net/kem.779.159

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