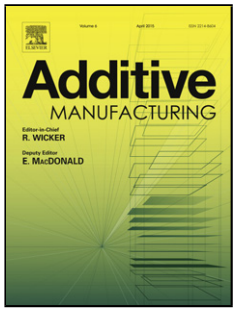

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Towards space-grade 3D-printed, ALD-coated small satellite propulsion components for fluidics

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Abstract

Space technology has been an early adopter of additive manufacturing (AM) as a way of quickly producing relatively complex systems and components that would otherwise require expensive and custom design and production. Space as an environment and long-term survivability pose challenges to materials used in AM and these challenges need to be addressed. Atomic layer deposition (ALD) is an effective coating method enabling conformal and precise coating of the complete AM print. This work analyses how an ALD coating of aluminium oxide on acrylonitrile butadiene styrene (ABS) and polyamide PA 2200 plastic AM prints benefits and protects them. This was studied in the context of in-space propulsion fluidics, where propellant flow properties also matter. AM was performed with material extrusion and selective laser sintering methods that are commonly used. Tests were performed with a simple bang-bang controller test setup and a mass spectrometer, and the existence of the coating was confirmed with scanning electron microscope imaging.

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