Low-pressure compressed air-based cold spray additive manufacturing applications

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Cold spray additive manufacturing (CSAM) has been used to manufacture parts for several industry sectors, such as aerospace, defence, and marine. This can be attributed to high-pressure (> 50 bar) inert propellant gas (N_2 or He) that facilitates metal printing by generating high kinetic powder velocities. In contrast, our research group at Swinburne University is working with lower pressure (30 bar) compressed air based CSAM system which does not require expensive inert gas consumables and is currently being advanced to a level capable of manufacturing parts that conform to various industry requirements. This poster showcases the capabilities of our CSAM system to manufacture structural and functional components, as both 3D bulk print parts as well as coatings. *Bulk 3D Printing:* (i) Al-bronze with pre-blend Cu and Al powders were printed and post heat treated to induce liquid phase sintering. This alloy exhibited up to twice higher ultimate tensile strength (298 MPa) with the similar ductility (9%) than in as-cast condition – UTS and ductility of 144 MPa and 9.8%, respectively. (ii) We successfully demonstrated printing ball-milled irregular-shaped Al7075 powders into coupons with the aid of annealing pre-treatment of the powders. *Coatings:* (iii) We also demonstrated retrofitting existing high touch surface parts (usually made of steel or aluminium) with highly efficient antimicrobial copper coatings**.** (iv) We are currently working on developing robust copper coatings on alumina (ceramic) substrates that can act as highly conductive metallic layer on an insulating underlying component, thereby facilitating a more cost-effective manufacturing composite for thermal management applications.