3D printing of hybrid metal/polymer objects through an integrated multiple material additive manufacturing process

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To efficiently produce complex functional devices while eliminating the need for assembly calls for a multi-material additive manufacturing technology (MMAM). This presentation introduces a novel 3D-printing system that integrates fused deposition modelling (FDM) and selective laser melting (SLM) to produce hybrid metal and polymer components. System design, operation procedure and the performances of the proposed 3D printing system are explicated. SLM printed metal and FDM printed polymer, both of which differ in material properties, are joined through interlocking structures, with their joining strength enhanced by laser heating. The mechanisms and scientific rationale that governs metal/polymer joining are discussed. Tensile and shear tests have confirmed good joint strengths of the printed metal/polymer components, which are created without adhesives. In addition, metal powder deposition onto the top of polymer through laser melting is demonstrated. Layers of copper (Cu10Sn) are successfully deposited onto the top of a PLA/SS 316L composite substrate. Several 3D components consisting of hybrid stainless steel (SS 316L), copper (Cu10Sn) and polymer (PLA, PET) are successfully printed and their potential applications are discussed.