Sustainable powders for laser-assisted additive manufacturing

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P1.020 Sustainable powders for laser-assisted additive manufacturing

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Welcome Function and Poster Session 1, Grand Hall, February 7, 2023, 5:35 PM - 7:30 PM

Sustainable materials are being used more commonly with additive manufacturing (AM) technique to enable the manufacture of functional products in a sustainable and economically efficient way [1]. Selective laser sintering (SLS), is an AM technique that shows potential in fusing and solidifying biomass powders into 3D porous materials, paving the way in technical applications [2, 3]. However, because of the low thermal stability of biomass under laser sintering, petroleum thermoplastic polymers, such as nylon, are often mixed with biomass powders to increase their processability for SLS applications [4]. In this latter situation, the interfacial interactions between biomass powder and thermoplastic remain one of the most important challenges that need to be addressed [5]. It is therefore important to develop a method that enables SLS printing of biomass powders directly.

In this work, we have developed an AM process for biomass powders using a laser sintering process with a commercial CO2 laser. The laser system is equipped with a chamber that has nitrogen flowing through it to prevent combustion of the powder. By using a layer-by-layer deposition technique, followed by laser sintering, a 3D structure can be directly printed from vegetal waxes and lignocellulosic composite powders. The morphological, chemical, and mechanical properties of the prepared 3D structures have been characterised by scanning electron microscopy (SEM), Fourier transform infrared spectrometer (FTIR) and dynamic mechanical thermal analysis (DMTA). The processability of wax powders with different particle sizes has been studied. This method is simple and requires no additional chemical or physical process, and it is potentially scalable for industrial applications.

Reference

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