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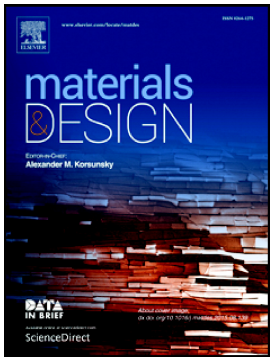

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Using laser cutting as a source of molten droplets for additive manufacturing: A new recycling technique

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Abstract

A new variant of additive manufacturing is proposed which involves transferring molten droplets via a laser beam to a substrate. The droplets are generated by laser remote fusion cutting of a supply sheet that could be a waste material, for recycling purposes. The laser-induced ablation pressure at the cutting front continuously drives melt downwards below the supply sheet in the form of a liquid column. Droplets separate from the column and solidify as a track on a substrate below. The droplets, surrounded by vapour, had in this case an average diameter of 500 µm and a speed of 2 m/s, with deviations up to 50%. Sound clad tracks were generated on steel and aluminium substrates. In the case of a copper substrate discontinuous clad tracks were produced as a result of poor wetting. The droplet jet had a small divergence of about 5°, which is suitable for controlled deposition. The transmitted part of the laser beam interacted with the clad track but did not affect the process result. High speed imaging was found to be a suitable tool for qualitative and quantitative analysis of the technique.

Keywords: Additive Manufacturing, laser remote fusion cutting, ablation, high speed imaging, deposition, droplet.