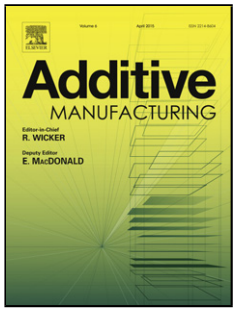

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Properties of copper modified polyamide 12-powders and their potential for the use as laser direct structurable electronic circuit carriers

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Abstract

Three-dimensional molded interconnect devices (3D-MID) are commercially produced by the laser direct structuring (LDS)-method with a market share of over 50 %. The process chain of this method starts with injection molding. The polymer of this part is functionalized with LDS-additives which allow the part to be laser structured subsequently. This technique is less suitable for prototypes and small-scale productions of 3D-MIDs because of its properties. Contrary to the injection molding process, the additive manufacturing (AM), such as powder bed based manufacturing processes, e.g. selective laser sintering (SLS), is a constantly emerging processing technology for the fabrication of prototypes and small-scale productions. It enables the tool-free manufacturing of highly complex parts. Unmodified polyamide 12 (PA 12), e.g. PA2200 (supplier: EOS GmbH) is most commonly used for the SLS of polymer parts. The LPKF Laser & Electronics AG in Garbsen, Germany, transferred the LDS-method to SLS-process. A standard SLS-polymer part is coated with a special paint, that contains the necessary LDS-additives. Once coated and dried, these parts can be laser direct structured similar to standard 3D-MIDs. In this study, the authors use copper particles in order to functionalize a standard polyamide 12 powder for laser activation and selective metallization. The study shows, that the addition of copper particles enables the laser direct structuring of polyamide 12. SLS-demonstrators were successfully laser activated and selectively metallized. Furthermore, the copper particles enhance the mechanical properties as well as the heat conductivity of polyamide 12.

Keywords: Selective laser sintering; LDS; 3D-MID; selective metallization; printed circuit carriers; polyamide 12; tensile properties; volume energy density

1. Introduction

Three-dimensional molded interconnect devices (3D-MIDs) are rigid three-dimensional PCBs, which allow the optimal use of the installation space due to their three-dimensionality. Compared to standard epoxy resin PCBs, they are lighter, recyclable and the process chain is shorter [1]. The most commonly used manufacturing method for 3D-MIDs is the laser direct structuring (LDS)-method invented by the LPKF Laser