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PROCEEDINGS

Selective Laser Sintering of Polymer Materials with Covalent Adaptable Networks Structure

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ABSTRACT

Selective laser sintering (SLS) is one of the mainstream 3D printing technologies. A major challenge for SLS technology is the lack of novel polymer powder materials with improved Z-direction strength. Herein, a series of polymer materials with covalent adaptable networks structure were utilized to solve the challenge of SLS. To verify this concept, novel kinds of cross-linked polyurethanes (TPU) or polydimethylsiloxane (PDMS) elastomers containing dynamic covalent bonds including halogenated bisphenol carbamate bonds [1], hindered pyrazole urea bonds [2] or Diels–Alder bonds [3] were synthesized. The obtained dynamic TPU or PDMS exhibited excellent mechanical strength and self-healing efficiency, in addition to SLS processing ability. Small molecule model study confirmed the dynamic reversible characteristics of the chlorinated bisphenol carbamate bond, hindered pyrazole urea bond and Diels–Alder bond, as confirmed by NMR or FTIR study. SLS 3D printing using the self-made self-healing TPU or PDMS powders was successfully realized. The interface interaction between the adjacent SLS layers can be significantly improved via dynamic chemical bond linking instead of traditional physical entanglement, which leads to an improved Z-direction mechanical strength.

KEYWORDS

SLS; self-healing; covalent adaptable networks; 3D printing, TPU, PDMS

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