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Abstract

Selective laser sintering was used for producing uniformly porous and graded porous polyamide structures. The porous structures were infiltrated with epoxy to produce composites. The porous and composite specimens were physically and mechanically characterized. Within the capabilities of the selective laser sintering machine and the materials used, porosities in the range 5–29% could be obtained in a controlled, repeatable manner. The ultimate tensile strength of the produced uniformly porous polyamide structures ranged from 20 MPa (for 29% porosity) to 44 MPa (for 5% porosity). The graded porous structures exhibited continuously changing porosity grades. As the number of grade increments rose, the grade profile fit closely with the design grade profile. The grades need to be constructed at porosities 9% or more for clear grade variation. Five percent porosity remained in all epoxy-polyamide composites after infiltration of the polyamide preforms with epoxy resin. Improvement in strength with epoxy infiltration was observed for preform porosities above 9%. The composite strength varied from 37 MPa to 44 MPa with respect to epoxy resin volume fraction. The maximum strength of the composites was found to be the same as the strength of the sintered polyamide powder (44 MPa).

Keywords
Selective laser sintering, porosity, graded materials, composites, additive manufacturing