2022 第十五届全国激光加工学术会议
15th National Conference on Laser Processing
2022年10月 | 武汉

光固化 3D 打印聚氨酯基透明牙套的设计应用研究

蒋倩[1]，张庆茂[2]，郭亮，严淼宁，

[1]华南师范大学，广东省广州市番禺区大学城，510000
[2]广州瑞通生物科技有限公司，510470

zhangqm@scnu.edu.cn

光固化 3D 打印技术作为一种高度灵活的加工技术，正迅速被主流采用，可应用于塑料、金属、陶瓷、混凝土和其他建筑材料。这些材料不仅提供必要的设计精度，而且还提供应用所需的物理和机械性能。目前的热固性树脂不能通过高温融化或溶剂溶化进行二次或多次使用，且性能较差，表现在打印后材料变脆、力学性能降低、收缩率高等方面。目前通过优化树脂配方、改变分子结构，以及填加改性填料等方法，可以显著改善光敏树脂的性能，提高光固化 3D 打印技术应用的多样性。

本研究将以自由基光引发体系选择聚氨酯丙烯酸酯作为光敏树脂的主体，通过添加稀释剂单体和助剂，优化树脂配方来提高光固化 3D 打印的性能希望能制备出一种机械强度高，打印精度良好的自由基型光敏树脂，对市面上不同的稀释单体 ACMO、TPGDA、IBOA 和双官能团、六官能团的聚氨酯丙烯酸酯进行混合后进行打印，并进行力学性能测试，因为稀释单体的种类及结构的不同能从根本上影响光敏树脂的机械性能，通过对不同稀释单体的测试得到拉伸强度与弯曲强度最好的自由基型光敏树脂配方。采用添加 BBOT 优化光敏树脂的打印精度，研究树脂配方、比例对样品力学性能的影响以及光固化打印参数曝光时间、功率对固化深度的影响，从而提高打印性能。以超高比表面积的纳米二氧化硅作为补强填料，利用硅烷偶联剂对纳米二氧化硅填料进行表面接枝改性，改善纳米二氧化硅在树脂中的分散效果，探究填料对树脂性能的影响。

关键词：DLP；聚氨酯丙烯酸酯；纳米二氧化硅；光敏树脂

*第一作者（报告人）联系方式：蒋倩、15520792239、1213022146@qq.com

Design And Application of Photocurable 3D Printing Polyurethane Transparent Braces

Photocurable 3D printing is rapidly gaining mainstream adoption as a highly flexible processing technology for plastic cermet concrete and other building materials that provide not only the necessary design precision, but also the physical and mechanical properties required for applications. The current thermosetting resin cannot be used twice or repeatedly by high temperature melting or solvent melting, and its performance is poor, which is manifested in the brittle mechanical properties of the material after printing and the reduction of high shrinkage rate. Currently, the resin formulation is optimized Changing the molecular structure and adding modified fillers can significantly improve the properties of photosensitive resins and enhance the diversity of applications of photocurable 3D printing technology.

This research will choose polyurethane acrylate with free radical initiator system as the main body of photosensitive resin, by adding diluent monomers and additives, and optimized resin formula to improve the performance of UV-curable resin to the preparation of a kind of high mechanical strength, and free radical photosensitive resin with good printing accuracy. Choosing ACMO; TPGDA; IBOA and double functional group mix and print. Then conducting mechanical properties test. The types and structures of different diluent monomer can fundamentally affect the mechanical properties of photosensitive resin. Through tests of different diluent monomer had their tensile strength and bending strength formula is the best type of free radical photosensitive resin BBOT was added to optimize the printing accuracy of photosensitive resin. The influence of resin formulation proportion on the mechanical properties of samples and the influence of photocuring printing parameters exposure time and power on the curing depth were studied to improve the printing performance. Nano-silica with ultra-high specific surface area was used as the reinforcing filler, and the silane coupling agent was used to graft the nano-silica filler on the surface to improve the dispersion effect of nano-silica in the resin, and the influence of the filler on the properties of the resin was investigated.

Key words: DLP, polyurethane acrylate, nano silicon dioxide, photosensitive resin