

Incorporating Quantum Dots into Additive Manufacturing Processes

Summary

Recent studies have shown the benefits that nanocomposite materials have over unmodified materials in regard to mechanical, chemical, and optical properties. Vanderbilt researchers have developed a technique for the incorporation of quantum dots into polymers for use in additive manufacturing processes. The process has been used to create a nanocomposite material with unique absorbance, fluorescence, and ultraviolet (UV) light excitation properties.

Addressed Need

Manufacturers seeking to utilize the unique properties and applications of quantum dots are constrained by the lack of a raw nanocomposite material compatible with time and cost effective production processes like 3D printing. Vanderbilt researchers have successfully developed a technique for the direct inclusion of quantum dots into polymer matrices to create a raw material that exhibits many of the desirable properties of quantum dots and is compatible with conventional 3D printers.

Technology Description

Cadmium selenide (CdSe) quantum dots were combined with raw polylactic acid (PLA) to create a model system of a nanocomposite that could be extruded and spooled for use with conventional 3D printers. The properties of the nanocomposite can be tailored with the optimal choice of size and quantity of quantum dots incorporated into the polymer.

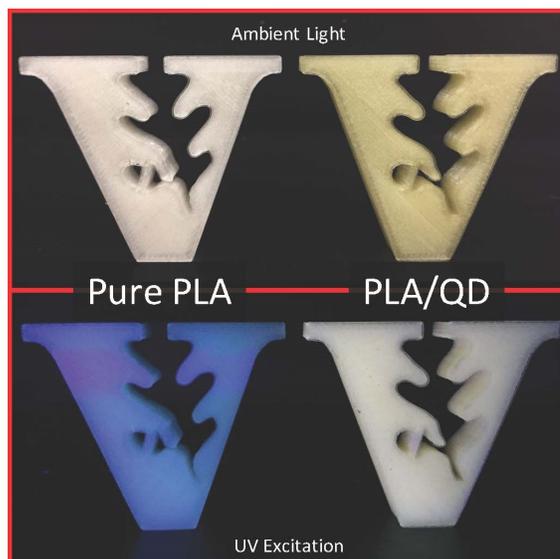


Figure 1: Comparison of optical properties of pure PLA (left) against the PLA/ CdSe nanocomposite (right). The top image shows the materials under ambient light, and the bottom image shows the result of UV excitation.

Unique Features

- ◇ The nanocomposite material is compatible with off the shelf 3D printers and does not show signs of degradation when stored in open air for 60 days
- ◇ Fluorescence of the nanocomposite material is more easily detectable and quantifiable than with traditional dyes and fluorophores
- ◇ PLA with CdSe quantum dots incorporated displays unique absorbance, fluorescence, and ultraviolet light excitation properties that can be quantitatively correlated to mechanical loading

Intellectual Property Status

Patent application has been filed.

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