Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

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Scalable Method for Continuous Synthesis of Upconverting Nanoparticles

Background

Upconverting nanoparticles (UCNPs) are materials that absorb infrared light and emit in the ultraviolet-visible-near infrared (UV-NIR) range. Thus, there is a large Stokes shift between excitation and emission, with no overlap. UCNPs—which typically include a $NaYF_4$ or $NaGdF_4$ matrix doped with other lanthanides—can be used for multimodal optical-electron microscopy or magnetic resonance imaging. These particles typically do not photobleach, even at high excitation power and duration, and can be excited by relatively low-power, continuous-wave infrared lasers. Emission depends on the dopant(s). Since infrared excitation is not photodamaging, does not excite background fluorescence, and penetrates deeper in tissues than do UV or visible excitation, these nanoparticles have potential for live animal and cell imaging, archived tissue imaging, and intraoperative imaging. However, current synthesis methods produce only a few milligrams of nanoparticles per batch over the span of two to three hours.

Invention Description

Researchers at Arizona State University have developed a method to synthesize upconverting nanoparticles (UCNPs) in a scalable, continuous flow fashion using a microwave reactor. The solvent for synthesis is a mixture of moderately polar, high-boiling-point plasticizers and oleic acid. More than a 20-fold increase in production rate over current methods can be expected, depending on microwave flow reactor setup.

Potential Applications

- Fluorescent microscopy
- Archived tissue imaging
- Cell and live animal imaging
- Intraoperative imaging

Research Homepage of Professor Alexandra Ros