Hedgehog Particles for Control over Light Scattering

Light scattering is a process wherein the path of light rays is affected due to irregularities in the medium that the light passes through. By controlling nanoscale features of small particles, one can control how light scatters, both in terms of the forward propagation of light and the backscattering (or reflection) of light. Such control is needed for applications such as optical coatings, diffusing light from LED sources, or creating obscurant clouds that prevent detection in the visible or infrared region of the spectrum. The current technology concerns the ability to control light scattering using hedgehog particles, which consist of zinc oxide spikes about a central polystyrene sphere.

High degree of spectral tuning, including enhancement of forward scattering and suppression of backscattering

Spectroscopy measurements show that these particles allow the forward propagation of light while suppressing backscattering. Furthermore, changing the feature size for the hedgehog particles allows one to control the location of the scattering peak. The hedgehog particles can be easily fabricated from inexpensive materials, and there is greater control of their feature size as compared other light scattering nanoparticles. Hedgehog particles are also amenable to many processing techniques as they are stable and avoid dispersion in either organic or aqueous solvents.

Applications

- Light scattering layers optical devices
- Antireflective coatings
- Obscurant clouds

Advantages

- Ability to control spike length and width gives control over light propagation spectrum.
- Ability to disperse hedgehog particles into a thin film.
- Film of hedgehog particles can additionally act as a hydrophobic surface
- Hedgehog particles have low adhesion to one another and are not prone to aggregation

Inventors

Nicholas Kotov