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Title: Doped Multifunctional Nanorods

Background: There is great interest in developing versatile and flexible nanomaterials that are multifunctional, multi-component, and multifaceted in their properties and hence, potential applications. The idea of creating smart nanomaterials that can be intrinsically and effectively responsive to multiple, often disparate sets of external stimuli, is of significant interest to both the academic as well as commercial community.

As an example, multifunctional nanoparticles with interesting magnetic and luminescent properties can be used as effective platforms for biomedical imaging, drug delivery, protein separation, cell sorting and MRI contrast imaging. In addition, incorporation of carbon nanotubes into a polymer matrix provides the composites with enhanced flexibility, transparency, conductivity, and mechanical strength.

Technology Description: This family of work conducted by Dr. Wong and his colleagues, merges the favorable properties of ternary metal oxides, key to magneto-optical and electronic devices, with alkaline-earth metal tungstates, known for having distinctive physical properties such as excitonic luminescence, thermoluminescence and stimulated Raman scattering. For the first time, Mn ions have been incorporated into the alkaline-earth metal tungstate scheelite matrix thereby generating a separate family of novel materials endowed with both desirable luminescent as well as magnetic properties, which mutually co-exist within one structure without any evident property dilution. That is, we have created reasonably homogeneously doped tungstates, which are truly multifunctional.

Applications: Uniform Mn-doped alkaline earth metal tungstate nanorods of reproducible size, shape and composition can be methodically prepared using a modified template-directed methodology under ambient, room-temperature conditions. What is much more important is the fact that the presence of Mn$^{2+}$ not only substantially increases the photoluminescent potential of a pristine tungstate material but also reinforces its versatility by adding a desirable magnetic component to its repertoire of properties. The multifunctional one-dimensional nanorods produced by this process demonstrate exciting opto-magnetic behavior which is of interest for functional nanoscale devices having a host of potential applications.

Advantages: Creation of multifunctional, single-crystalline one-dimensional nanostructures with controllable size, shape and morphology through the utilization of a facile, modified template-directed technique that operates under ambient conditions. As-prepared Mn-doped alkaline-earth metal tungstate nanorods possessed noticeably higher luminescence intensities, as compared with their pure alkaline-earth metal tungstate counterparts. Moreover, these doped nanorods demonstrated antiferromagnetic behavior comparable to MnWO$_4$. The process utilizes stable, reasonably non-toxic precursors in an aqueous solution, and minimizes the generation of harmful products.

Patent Number / Publications: Patent Pending

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