Method of Preparing Vanadium Oxide Nanoparticles

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Summary

This technology provides a method for preparing vanadium dioxide (VO_2) nanoparticles having controlled size utilizing inverse micelle hydrolysis

Technology Background

Semiconductor-to-metal phase transition temperature for VO_2 is 340 K. Below 340 K, VO_2 is a semiconductor with monoclinic unit cell symmetry. At temperatures above 340 K, VO_2 becomes metallic and adopts tetragonal unit cell symmetry. With this phase transition VO_2 experiences many drastic changes, such as a rapid decrease in optical transmittance in the near-IR and an increase in resistivity. These properties allow the use of VO_2 in a wide range of applications, including thermochromic materials, electrical switches, optical storage, self-protecting support windows, erasable optical data recording, thermal sensors, coatings for energy-efficient windows and thermal sensors and relays.

Substances like VO_2 in which both sensing and actuating capabilities are coupled by an intrinsic control mechanism are sometimes referred to as “smart” materials. The above-described phase transition of VO_2 is accompanied by extraordinary changes in its electronic and optical properties. When a VO_2 film is coated onto a transparent substrate, and illuminated so that the film absorbs sufficiently intense laser light, the resulting temperature increase can induce a rapid semi-conducting-to-metal phase transformation. The presence of the metallic VO_2 phase then produces a reflecting surface that subsequently strongly attenuates further transmission of the incident laser radiation through the coated substrate. Accordingly, the VO_2 film performs both sensing and actuating functions through coupled intrinsic properties of the material.

Technology Description

Vanderbilt scientists have invented several chemical synthesis methods for creating VO_2 nanoparticles having smaller sizes than those achieved by conventional methods. These methods rely on confining the sol-gel reaction of vanadyl reagents to aqueous regions within inverse micelles, allowing the creation of vanadium oxide nanoparticles of controlled size. This control of nanoparticle size significantly influences the electronic and optical properties of the resulting VO_2 nanoparticles, allowing these properties to be customized for particular applications.

Intellectual Property Status

» US Patent 8,318,128 issued in 11/2012 (http://www.google.com/patents/US8318128)
» Faculty webpage and list of publications http://www.vanderbilt.edu/chemistry/faculty/lukehart.php

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