Lanthanide Oxide Nanoparticle Film Deposition Process

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

Vanderbilt researchers have developed a method for forming a film of lanthanide oxide nanoparticles using electrophoretic deposition. This technique is straightforward to set up and provides thickness control at high deposition rates, enabling site selective particle assembly for any size and shape.

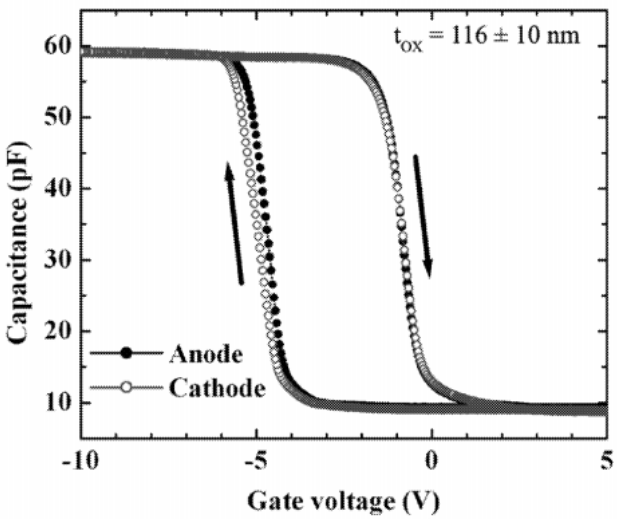

Figure 1: The capacitance and voltage characteristics of a metal-oxide semiconductor capacitor that was fabricated from nanocrystal films using the developed method is shown here.

Addressed Need

Lanthanide oxides such as europium oxide (Eu_2O_3) and gadolinium oxide (Gd_2O_3) are known for their light emitting and high-k dielectric properties, respectively. The Eu^{3+}-doped Gd_2O_3, in microcrystalline form, has been employed in video displays and tri-color fluorescent lamps as a red phosphor. Recently, the nanocrystalline form of Eu^{3+}-doped sesquioxides has gained research interest due to its potential use in luminescent biological tags, efficient light emitting devices, and high-resolution displays. Similarly, Gd_2O_3 has received research attention because of its high-k dielectric properties and it has been proposed as a silicon dioxide replacement for gate oxide in ultra-small complementary metal-oxide-semiconductor (CMOS) devices. However, because most applications of luminescent and dielectric materials require their implementation in thin-film form, Eu_2O_3 and Gd_2O_3 nanocrystals need to be assembled into thin-film form to study their optical and dielectric properties.

Technology Description

The method utilizes two substrates that are positioned apart from one another and have a voltage applied between them. Upon immersion of the substrates into a solution comprised of lanthanide oxide nanoparticles suspended in hexane, a film of lanthanide oxide nanoparticles forms on the conducting surface of one of the substrates. Upon completion of this immersion step, the substrate with the nanoparticles is exposed to air while the voltage continues to be applied, effectively drying the film of lanthanide oxide nanoparticles onto the substrate.

Intellectual Property Status

Two US patents have been issued (8,524,613 and 8,405,138).

CTTC CONTACT:
Ashok Choudhury
(615) 322-2503
ashok.choudhury@vanderbilt.edu

INVENTORS:
James H. Dickerson, Ph.D.
Sameer V. Mahajen, Ph.D.

VU REFERENCE: VU 1034

Visit **http://cttc.co/technologies** for available Vanderbilt technologies for partnering