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Functional oxide nanoarchitectures for emerging energy and clinical technologies

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Functional materials change specific physicochemical properties under the action of external stimuli such as light, electric field, magnetic field, temperature, pressure or atomic/molecular interaction and this behavior makes them highly relevant both scientifically and technologically. Oxide semiconductors such as titanium dioxide and zinc oxide belong to this category. These are earth-abundant and low cost materials useful for a wide range of applications including electronics, optoelectronics, photovoltaics, photocatalysis and chemical sensing. Nanoarchitectures of these materials exhibit unique properties and as a result, a number of methods have emerged for developing them. Anodic oxidation is a century old industrial process traditionally used for growing protective oxide films on metals such as aluminum and titanium. The process is currently known primarily for its ability to yield highly ordered one-dimensional nanoarchitectures such as nanotube and nanowire arrays. Titania nanotube array architecture has already been widely explored for various applications including solar energy conversion. Recently, a zinc oxide nanotube-nanowire hybrid structure developed using anodic oxidation exhibited promising characteristics for use as chemiresistive sensors for early non-invasive detection of breast cancer. This talk will focus on the specific properties of these oxides for applications in energy conversion technologies such as hybrid solar cells and solar fuel generation processes as well as in clinical devices for early detection of cancer.

Image

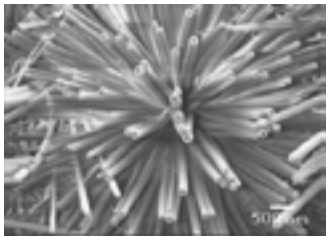

Figure 1: High surface area zinc oxide nanotube architecture fabricated using anodic oxidation of zinc in an environmentally friendly way. Chemiresistive sensors were developed using this architecture for the early detection of breast cancer [1].

Biography

Oomman K Varghese is an Associate Professor in Department of Physics at University of Houston. After receiving PhD degree in 2001 in Physics from Indian Institute of Technology Delhi (IITD), he worked as a Post-doctoral scholar in University of Kentucky and also in The Pennsylvania State University. Later, he was employed as Chief Scientist at Sentech Corporation, Pennsylvania and then as Development Engineer at First Solar, Ohio. In 2011, Thomson Reuters ranked him 9th among 'World's Top 100 Materials Scientists' in the past decade. In 2014 and 2015, he received the title 'Highly Cited Researcher' and had his name listed in 'World's Most Influential Scientific Minds'.

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