ORNL devises recipe to fine-tune diameter of silica rods

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By controlling the temperature of silica rods as they grow, researchers at the Department of Energy's Oak Ridge National Laboratory could be setting the stage for advances in anti-reflective solar cells, computer monitors, TV screens, eye glasses and more.

The goal of fabricating fixed-size one-dimensional silica structures and being able to precisely control the diameter during growth has long eluded scientists. Now, Panos Datskos and Jaswinder Sharma have demonstrated what they describe as the addressable local control of diameter of each segment of the silica rod.

"In nature, many intricate structures develop and grow in response to their environments," said Sharma, a Wigner Fellow and corresponding author of the *Angewandte Chemie* International Edition paper that outlines the process. "For example, in addition to genotype, shell shape is also controlled by the local environment in many oysters and scallops."

Taking a cue from nature, by manipulating the reaction temperature during growth, Sharma and co-author Datskos were able to control thickness while retaining control of each segment of the rod separately.

When the researchers increased growth temperatures, the segment diameter became smaller. By increasing incubation times, they obtained longer segments at the same temperature. Higher temperatures for the same incubation time produced longer segments of the glass-like silica rods.

It appears that the correlation between temperature and diameter is a result of the relationship between temperature and the size of the emulsion droplet, according to the authors, who discovered that the higher the temperature, the smaller the emulsion droplet.

The researchers envision this finding leading to further opportunities that require vertically aligned arrays of silica rods for gradually changing a refractive index on a large scale. The paper, titled "Synthesis of Segmented Silica Rods by Regulation of the Growth Temperature," is available at http://onlinelibrary.wiley.com/doi/10.1002/anie.201308140/full.

Provided by Oak Ridge National Laboratory