

# Researchers develop new method for nanomaterials synthesis

March 30 2006

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Virginia Commonwealth University chemists, using a simple, commercial microwave oven, have developed a new method for the synthesis of nanomaterials that can control the dimensions and properties of rods and wires that are just one billionth of a meter in size.

The method, known as microwave irradiation, or MWI, is considered a fast and easy way to create highly versatile, tailored nanorods and nanowires to be used in medical applications, drug delivery, sensors, communications and optical devices because microwave heating can provide significant enhancement in reaction rates.

M. Samy El-Shall, Ph.D., professor of chemistry and affiliate professor of chemical engineering at VCU, is discussing his ongoing work of the design, synthesis and characterization of nanoparticles at the American Chemical Society National Meeting & Exposition in Atlanta, March 26-30. In addition, his colleague, Asit Baran Panda, a post-doctoral fellow in the VCU Department of Chemistry, will present this study.

"The synthesis of new materials made of particles, rods and wires with dimensions in the nanometer scale is among the most active areas of research in science due to the unique properties of these materials compared to conventional materials made from micron sized particles," said El-Shall, who is lead author of the study.

"MWI is unique in providing scaled-up processes thus leading to a potentially important industrial advancement in the large-scale synthesis

of nanomaterials," said El-Shall.

Most methods currently used to synthesize nanomaterials are complicated, require specific equipment and produce small amounts of nanomaterials," he said.

Although MWI process involves the use of a conventional microwave, it requires a defined recipe of chemicals and solvents to create the nanomaterials in the laboratory setting.

The advantage of using a microwave is that the energy goes directly through molecules compared to thermal heat which just applies heat to everything. In addition, El-Shall said that the nanorods and nanowires made by this method self-assemble into uniform aligned arrays of rods with well-controlled spacing between the rods. This is critical to be able to measure their individual conductivity and fluorescence, he said.

"The key issue here is the control of the size, shape and lateral dimensions of nanostructures because these nanoparticles in the form of rods, wires, belts, cubes, etc., are the building blocks used in devices and processes such as light-emitting diodes, solar cells, single electron transistors, lasers and biological labels," he said.

Furthermore, El-Shall and his research team found that nanorods that are 1nm wide and 5-6nm long could be synthesized in just 30-60 seconds; while longer nanowires, 1.5nm wide and 350nm long, could be synthesized in two minutes. Traditional methods take many more hours to synthesize such materials.

El-Shall and his team are currently examining how to apply this basic principle to a broader scale to synthesize nanowires with multiple functions such as fluorescence, conductivity and magnetism.

Source: Virginia Commonwealth University

Citation: Researchers develop new method for nanomaterials synthesis (2006, March 30)  
retrieved 9 April 2024 from <https://phys.org/news/2006-03-method-nanomaterials-synthesis.html>

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