Waterborne bacterial diseases represent a major global problem killing over two million people worldwide annually, mostly children in developing countries. Conventional filters used to prevent such diseases are made from membranes but clogging of such devices is a common problem. A new strategy for deactivating bacteria by incorporating antibacterial silver nanowires (Ag NWs) in a carbon nanotube (CNT)-coated cotton fiber matrix has now been demonstrated. The material is mechanically robust, electrically conductive, and uses a very small amount of current to inactivate bacteria, while the open structure allows for high volume water filtration. The work led by Y. Cui and S. Heilshorn at Stanford University was published in the September 8th issue of Nano Letters (DOI: 10.1021/nl101944e; p. 3628).

Three components with different functionalities spanning three length scales formed the filter: (1) inexpensive single-shell nanoparticles are present, to 960 ± 20 MPa after the second aging, when core–multishell nanoparticles are also present providing evidence that the more complex multishell architecture has an advantage over core–single-shell particles.

The researchers said that this solid-state synthesis technique should be generally applicable to a range of alloys. Key considerations are (1) choice of alloying elements, relative diffusivities, and solubilities, and (2) choice of aging temperatures, which significantly affects the ability to segregate the elements and form multiple shells.

Continued tuning and understanding of the effects of complex multishell (and multicore) nanoparticles within solid matrices will allow greater flexibility in tailoring alloy mechanical properties.

Alia P. Schoen

Nano Focus
Electrified nanostructures enable low-cost water sterilization

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DOI: 10.1021/nl101944e; p. 3628.

A representative particle has a core region of about 3.3 nm, a 1.8-nm thick (on average) first shell, and a 10-nm thick (on average) second shell. As an interesting case, one of these particles was actually a multicore–multishell particle containing two cores with single-shell encapsulated together in a δ-Al₃Li second shell.

According to the researchers, this is a demonstration of the limitation of control over nanoscale features with this technique, but also an unexpected new architecture possible with this solid-state synthesis technique representing a minor but measureable subpopulation. Vickers microhardness tests show an increase in microhardness from 725 ± 10 MPa after the first aging step, when the core–single-shell nanoparticles are present, to 960 ± 20 MPa after the second aging, when core–multishell nanoparticles are also present providing evidence that the more complex multishell architecture has an advantage over core–single-shell particles.

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