

Inorganic nanotubes and inorganic fullerene-like materials from layered compounds: from concept to applications

Reshef Tenne¹

¹Weizmann Institute of Science
Department of Materials and Interfaces
Rehovot 76100
Israel

We have proposed that nanoparticles of layered compounds will be unstable against folding and close into fullerene-like structures and nanotubes (IF). Initially this hypothesis was realized in WS₂ and MoS₂. Subsequently, nanotubes and fullerene-like structures were prepared from numerous compounds of layered structure by various groups. Much progress has been achieved in the synthesis of inorganic nanotubes and fullerene-like nanoparticles of WS₂ and MoS₂ and many other metal dichalcogenides over the last few years. Synthetic methods for the production of multiwall WS₂ nanotubes by sulfidizing WO₃ nanoparticles have been described and further progress is underway. A fluidized-bed reactor for the synthesis of up to 70 g of fullerene-like WS₂ nanoparticles has been established and scale-up of the synthesis to pilot industrial production is under way. The detailed mechanisms for the synthesis of fullerene-like WS₂ and MoS₂ nanoparticles and nanotubes of these compounds have been elucidated. The synthesis and the structure of various IF materials from metal-dihalides will be discussed as well.

Substantial progress has been achieved in the use of such nanoparticles for tribological applications. Few testing programs have been undertaken together with industrial partners and have clearly indicated the usefulness of the fullerene-like WS₂ (MoS₂) as solid lubricants in various products. Some of these applications will be briefly described.