

NANO HIGHLIGHT

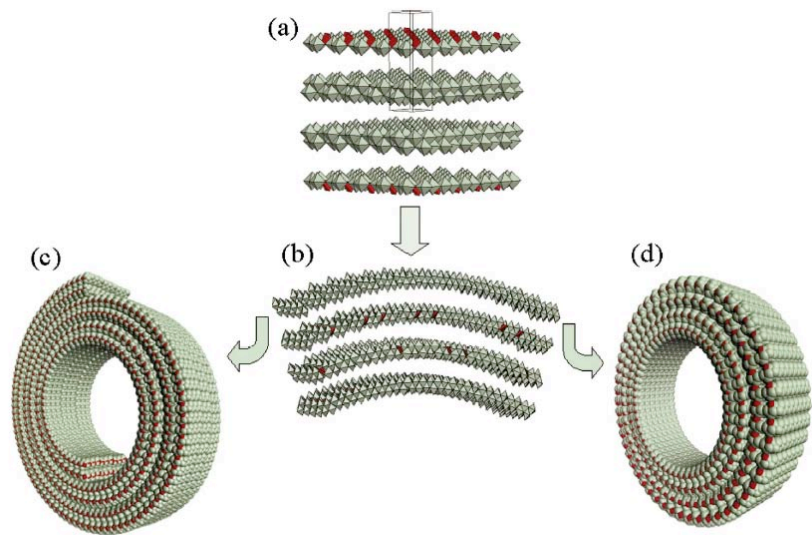
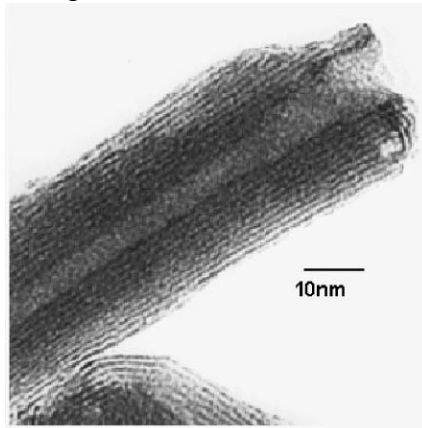
Nano Jelly Rolls: The Atomic Structure of Vanadium Oxide Nanoparticles

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Manufacturing a material with nanometer length dimensions imbues it with special properties coming solely from its small size. This is the basis of nanotechnology [1]. For example, great excitement exists about the properties of hollow carbon nanotubes called buckytubes [2], but can other materials be manufactured into nanotubes and have their properties similarly enhanced? One example is vanadium pentoxide, V_2O_5 . In the bulk the material is useful in applications such as optical switches, chemical sensors, catalysts and solid-state batteries. In the form of nanotubes



these properties are further enhanced, but in addition, completely novel applications such as nanoactuators and

nonlinear optical limiters are envisaged [3]. A severe limitation to its full implementation in technology is a lack of knowledge of its atomic scale structure in the nanocrystalline form. This is a generic problem with nanostructured materials since conventional crystallographic methods of structure solution don't work on the nanoscale. The NSF funded NIRT-Structure of Nanocrystals is addressing this need by developing and applying advanced scattering methods to solve the structure of nanoparticles [4].

Earlier we resolved a long-standing controversy about the atomic structure of nanoporous V_2O_5 xerogel [5] and showed it to be made of flexible layers of edge-shared octahedra. NIRT researchers have now shown [3] that, in the V_2O_5 nanotube, these layers appear to roll up resulting in the nanotube: a nanometer length-scale jelly roll.

References

- [1] Nanotechnology has a definition. See <http://www.nano.gov/html/facts/whatIsNano.html>
- [2] R. Saito, G. Dresselhaus and M.S. Dresselhaus, *Physical Properties of Carbon Nanotubes* (Imperial College Press, London, 1998)
- [3] V. Petkov, P.Y. Zavalij, S. Lutta, M.S. Whittinham, V. Parvanov and S. Shastri, *Phys. Rev. B* **69**, 085410 (2004)
- [4] For further information about this project link to <http://nirt.pa.msu.edu/> or email billinge@pa.msu.edu
- [5] V. Petkov, P.N. Trikalitis, E.S. Bozin, S.J.L. Billinge, T. Vogt and M.G. Kanatzidis, *J. Am. Chem. Soc.* **124**, 10157 (2002).