Synthesized hierarchical structures in solid-state chemistry

Scientific Achievement

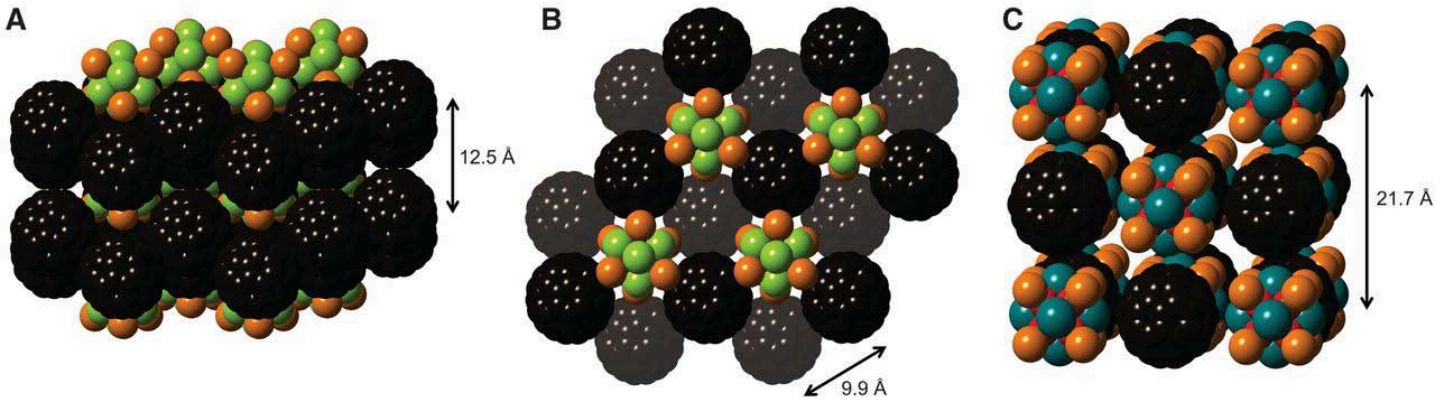
Developed 3 new solid-state compounds formed from atomically precise molecular clusters

Significance and Impact

Using molecular clusters as "atomic" building blocks, instead of simply atoms, allows for more finely tuneable structures and creates the possibility for solids with new properties.

Research Details

- Created three conductive solid-state materials and characterized their structures using X-ray scattering
- Found that when molecular clusters combine, they arrange themselves in similar lattice structures to atoms, with a dramatically increased length scale that produces collective properties, such as electrically conducting networks and magnetic ordering.



Space-filling structure of solid-state compound 1•2C60, showing the crystal packing looking along (A) the ab plane and (B) down the c axis. (C) Space-filling structure of 3•C60. Carbon, black; nickel, red; cobalt, blue; phosphorus, orange; tellurium, teal; selenium, green. The ethyl groups on the phosphines were removed to clarify the view.

X. Roy, C. Lee, A. Crowther, C. Schenck, T. Besara, R. Lalancette, T. Siegrist, P. Stephens, L. Brus, P. Kim, M. Steigerwald, C. Nuckolls. *Science* **341** (2013): 157-160

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