ed for each day of beam time, but only six bohrium nuclei were actually detected. The bohrium 267 compound was shown to be volatile at 180°C, behaving much like its periodic-table relatives technetium and rhenium.

Crystal-Bonding Principles Established for Compounds Such as Neodymium Distannide

Researchers at Cornell University have established the principles of crystal-bonding of a group of thousands of compounds that carry significant electronic and magnetic properties.

"This is an important step in understanding the bonding in alloys and intermetallic compounds," said Roald Hoffmann, Nobel Laureate for chemistry (1981) and the Frank H.T. Rhodes Professor in Humane Letters at Cornell. Working with postdoctoral researcher Garegin Papoian, Hoffmann laid out a theory that extends the understanding of bonding in a particular class of alloys.

As reported in the July 17 issue of *Angewandte Chemie*, the two researchers began by looking at the bonding of compounds of antimony, tellurium, tin, and selenium. The compounds have names like europium, lithium antimonide, and neodymium distannide, and although they have been known for many decades, "experimentalists have said nothing about what holds these compounds together," said Hoffmann.

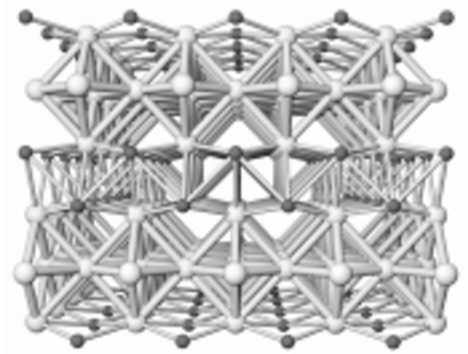

Figure 1. A perspective view of the crystal structure of neodymium distannide, a compound of tin and the rare-earth metal neodymium. The small dark spheres are neodymium, and the large light spheres are tin. Credit: Garegin Papoian. © 2000 Cornell University.

These compounds consist of a melange of metallic, covalent, and ionic bonds that the researchers explain in a formula based on "magic numbers." In their bonding formula, magic numbers are the electron counts that indicate whether a stable compound is linear or square: seven electrons per atom for a linear chain; six electrons per atom for a two-dimensional square lattice; and five electrons per atom for a simple cube lattice (see Figure 1).

The crystal structures themselves can be seen in a series of computer-generated drawings—not based on theory, but on direct experimental work—that have an interlocking, architectural perfection. The molecular structures, ranging from simple geometries to complex lattices, reveal their bonding networks in a series of multidimensional building blocks.

Hoffman said, "Some look terribly complicated, but take them apart and you can see square lattices with atoms above and below, and squares forming octahedrons."

Hoffman said that such structures reveal themselves sometimes as compounds of antimony and other times as tellurium or tin because the number of electrons determines the chemistry, less so the identity of the nucleus underneath.

Nobel Prizes for 2000 Announced

The Royal Swedish Academy of Sciences has awarded the Nobel Prize in chemistry for 2000 jointly to **Alan J. Heeger** of the University of California—Santa Barbara, **Alan G. MacDiarmid** of the University of Pennsylvania, and **Hideki Shirakawa** of the University of Tsukuba, Japan, "for the discovery and development of conductive polymers."

For a polymer to be able to conduct electric current, it must consist alternately of single and double bonds between the carbon atoms. It must also be doped, enabling the holes or extra electrons to move along the molecule, becoming electrically conductive. Heeger, MacDiarmid, and Shirakawa made their seminal findings at the end of the 1970s and have subsequently developed conductive polymers into a research field yielding practical applications.

The Academy has awarded the Nobel Prize in physics for 2000 to scientists and inventors whose work has laid the foundation of modern information technology (IT), particularly through their invention of rapid transistors, laser diodes, and integrated circuits (chips). One-half of the prize is awarded to **Zhores I. Alferov** of A.F. Ioffe Physico-Technical Institute in St. Petersburg, Russia, and **Herbert Kroemer** of the University of California—Santa Barbara, "for developing semiconductor heterostructures used in high-speed- and opto-electronics" and one-half to **Jack S. Kilby** of Texas Instruments, Dallas, "for his part in the invention of the integrated circuit." □