

**o.m7.o1** Low-dimensional conducting forms of carbon.

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In the last decade the progress in the research of carbon based nanostructures has been spectacular. The discovery of the C<sub>60</sub> fullerene molecule in 1985 and its synthesis in large quantities in 1990 opened a new field of carbon chemistry and physics. The electron attracting character of the weakly conjugated  $\pi$  electron system made C<sub>60</sub> a precursor of thousands of organic derivatives. In contrast to most molecules, C<sub>60</sub> retains its chemical reactivity in the crystalline form resulting in a rather extended solid state chemistry. From the very beginning, alkali fulleride compounds attracted considerable interest since a number of them are superconducting "synthetic metals" with transition temperatures superseded only by the perovskites. The proposition in 1994 that C<sub>60</sub><sup>-</sup> ions form linear polymeric chains in orthorhombic AC<sub>60</sub> alkali fullerides has opened the field of low-dimensional fullerene structures. Multiwall nanotubes (MWNT) were discovered in 1991, onion-like structures in 1992 and single wall nanotubes (SWNT) were reported in 1993. These discoveries marked a new era in the physics and chemistry of carbon nanostructures. In this talk few examples of the physical properties of electrically conducting fullerides, fulleride polymers and nanotubes will be presented.

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**o.m7.o2** Structural modification of fullerenes and carbon nanotubes by high pressure treatment.

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Fullerenes and carbon nanotubes are at present of very large interest because of their interesting physical and chemical properties, and in many cases interesting future applications can be envisaged.

Pristine fullerenes such as C<sub>60</sub> form 3D lattice structures. However, high temperature treatment under high pressure leads to a strong intermolecular interaction and under certain conditions covalent bonds form between the molecules. This results in the formation of "polymeric" structures containing the fullerene molecules as the basic building blocks. Depending on the exact conditions under which polymerization is carried out the polymeric phases can be more or less ordered, and there is a general trend that the number of inter-molecular bonds per molecule increases with increasing treatment pressure and temperature. Low-dimensional (1D or 2D) polymers are usually formed at pressures below 8 GPa. At low temperatures, linear chains of C<sub>60</sub> molecules are formed. Because polymerization occurs between nearest neighbours this results in an ortho-rhombic distortion of the initially cubic lattice. At higher temperatures 2D planes are formed, tetragonal or rhombohedral depending on whether polymerization occurs in the (110) or (111) planes. Treatment at very high temperatures and pressures results in the formation of extremely hard 3D polymerized phases. The production, structures and physical properties of the polymeric phases of C<sub>60</sub> are briefly discussed, as are possible ways to modify these structures further.

Carbon nanotubes are intrinsically 1D materials with enormous strength and very interesting transport properties dominated by quantum effects. The electronic properties depend strongly on details of the structure, such that almost identical tubes can be either metallic or semiconducting, and a small structural flaw on a tube can change the properties from metallic to semi-conducting in the middle of a tube, forming an intrinsic metal-semiconductor junction. Suggested applications range from high-strength composites over electron emitters in computer displays to molecular electronics. We discuss whether high pressure can be used to modify tubes or bundles of tubes in ways that may be useful for future applications.