Making stronger carbon allotropes

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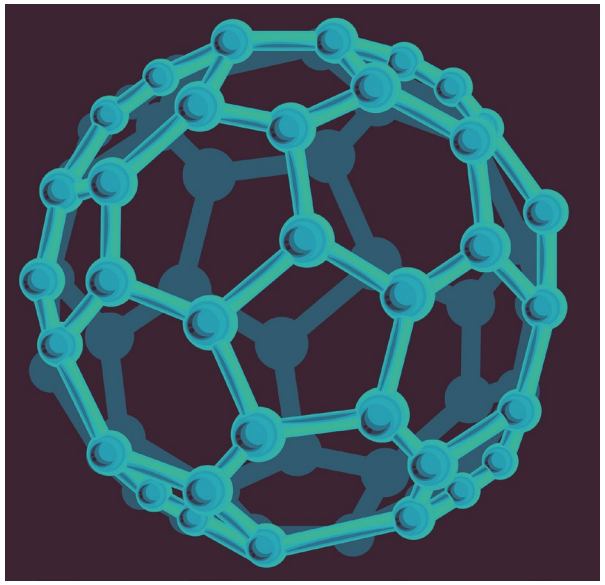
When buckminsterfullerene C_{60} is compressed at 5GPa, at temperatures above 800˚C, it forms a disordered carbon material with a compressive strength like diamond. The extreme conditions cause the fullerene's bonding character to change from three bonds per atom (called sp^2) to four (sp^3). The resulting material's physical properties depend on the ratio of sp^2 to sp^3 carbons. Raising the temperature during reaction increases the sp^3 fraction, producing a harder material. The hardest among these materials was created at 1200˚C. Its tetragonally-arranged network of carbons is so hard it can scratch diamond and is of a similar strength. But unlike diamond, the material acts as a semiconductor.



Structure of buckminsterfullerene

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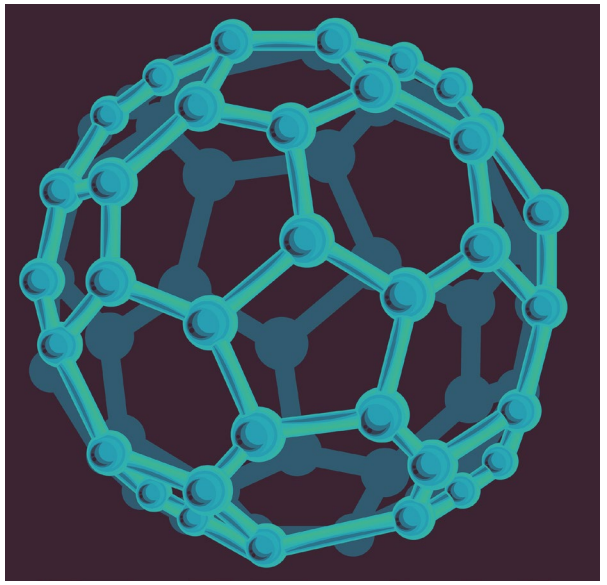

Structure of buckminsterfullerene

1. In buckminsterfullerene what type of bond is between the carbon atoms?
2. Explain why diamond is a very hard substance.
3. Describe the structure of fullerenes.

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