Superconductivity in diamond

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As well as holding pride of place as the most sought-after of all precious gemstones, diamond possesses a dazzling array of technologically useful properties. As well as being the hardest, most thermally conducting, and chemically resistant of all known materials it is also biocompatible, highly transparent and of great interest for use in the electronics industry. And now, to top it all off, Evgeni Ekimov and colleagues report in Nature, that under the correct conditions, it can also become a superconductor.

The diamonds they used were grown by the conventional industrial technique of subjecting graphite to high pressure and temperature, but to make it electrically conducting they added 2.8% of boron during growth, which contributes positive charge carriers (holes) to the material.

Authors report the discovery of superconductivity in boron-doped diamond synthesized at high pressure (nearly 100,000 atmospheres) and temperature (2,500–2,800 K). Electrical resistivity, magnetic susceptibility, specific heat and field-dependent resistance measurements show that boron-doped diamond is a bulk, type-II superconductor below the superconducting transition temperature T_c 4 K; superconductivity survives in a magnetic field up to $H_{c2}(0)$ 3.5 T. The discovery of superconductivity in diamond-structured carbon suggests that Si and Ge, which also form in the diamond structure, may similarly exhibit superconductivity under the appropriate conditions.