On the quest of superconductivity at room temperature at graphite interfaces

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ABSTRACT

Superconductivity is the phenomenon in nature where the electrical resistance of a conducting sample vanishes completely below a certain temperature, the "critical temperature T_c". Superconductivity, discovered in 1911, is one of the most studied phenomena in experimental and theoretical solid state physics. It has important applications, like the generation of high magnetic fields using superconducting solenoids cooled at liquid He (4K) up to liquid nitrogen (77K) temperatures, or the use of extremely sensitive magnetic field sensors via the Josephson effect. Among solid state physicists there exists a kind of unproven law regarding the (im)possibility to have superconductivity at room temperature, which means to have a material with a $T_c > 300$K. This over-skepticism is the reason why no systematic search for this phenomenon in graphite was done for several decades after the work of Kazimierz Antonowicz [1]. Different measurements done in the last 17 years in oriented pyrolytic graphite, graphite powders [2] and natural graphite [3], however, strongly suggest that room temperature superconductivity is localized at some interfaces in the graphite structure. This may explain several aspects of this hidden superconductivity, like low reproducibility, time instability, small amount of superconducting mass and the difficulty to localize the superconducting phase(s).

Theoretical work indicates that at certain graphite interfaces a dispersion-less relation, a flat band, for conduction electrons exists, which would strongly enhance the critical temperature. The talk summaries old and new experimental facts, which speak for the existence of superconductivity with a critical temperature above 350 K in graphite.

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[3] Precker C. E. *et al.*, New J. Phys. **18**, (2016) 113041.