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Superconductivity in Graphite Intercalation Compounds

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Graphite intercalation compounds (GICs) are quasi-two-dimensional systems consisting of graphene layers and intercalated foreign species. By introducing metal atoms or molecules between the graphene layers, we can modify the electronic structure of graphite significantly and thus change its physical properties. One of the examples is inducing superconductivity by intercalating alkaline metal. Recent discovery of "unusually high-T_c" superconductivity had renewed the interest in Ca-intercalated graphite. We have carried out (1) synthesizing high-quality graphite intercalation compounds[1], (2) investigating various physical properties including transport, magnetic, and thermodynamic properties at low temperatures[1,2] and (3) searching for new superconducting graphite intercalation compounds[3]. Our research on GICs provides experimental evidence for strong electron-phonon coupling, and also for a significant anisotropy in the superconducting gap[1,3]. Furthermore, we discovered superconductivity in SrC_6, the missing link between two seemingly different groups of superconducting GICs: unusually high- T_c alkaline-earth GICs and previously-known low-T_c alkali-GICs. Implications of the present findings on the superconducting mechanisms in alkaline-earth as well as alkali- intercalated graphite will be discussed.

Keywords : Graphite intercalation compounds, electron-phonon coupling, superconducting gap