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**Superconductivity in alkaline earth-intercalated graphites: $CaC_6$ and $SrC_6$**[1]

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The recent discovery of superconductivity in alkaline earth-intercalated graphites $CaC_6$ ($T_c$ = 11.5 K) with substantially higher $T_c$'s than the previously known, has renewed the interest in the graphite intercalated compounds and stimulated a debate about the relevant pairing mechanisms. We have investigated the superconducting properties of high-quality $CaC_6$ samples, using specific heat ($C_P$) and magnetization measurements. For $CaC_6$, the exponential temperature dependence of the electronic $C_P$ and its linear dependence on the magnetic fields provide evidence for a fully-gapped, intermediate-coupled, and phonon-mediated superconductor without essential contributions from alternative paring mechanisms. However, the $C_P$ anomaly at $T_c$ is found to be much smaller than expected from theory, indicating a possible anisotropy in the superconducting gap. Consistently, the anisotropy of the upper critical field $H_{c2}^{\parallel}/H_{c2}^{\perp}$ is also larger than expected from the Fermi velocities, and shows significant temperature dependence below $T_c$. Recently, we also discovered the superconductivity in $SrC_6$ at $T_c$ = 1.65(6) K as well as the absence of superconductivity in $BaC_6$ down to 0.3 K. Similar to $CaC_6$, the $C_P$ anomaly of $SrC_6$ is somewhat lower than that theory predicted, but the discrepancy is much reduced. The anisotropy of $H_{c2}$ for $SrC_6$ is also found to be much smaller than that of $CaC_6$, indicating a reduced superconducting gap anisotropy. Finally, we will discuss the significantly lower $T_c$ of $SrC_6$ than $CaC_6$ as well as their positive pressure dependence in terms of the *e-ph* coupling with the in-plane intercalant and the out-of-plane C phonon modes, based on *ab-initio* calculations. Implications of the present findings on the superconducting mechanisms in alkaline-earth as well as alkali- intercalated graphites will also be given.

[1]Work done in collaboration with L. Boeri, F. S. Razavi, J. R. O'Brien, and R. K. Kremer.