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Superconductivity with strong electron-phonon coupling in noncentrosymmetric W_3Al_2C

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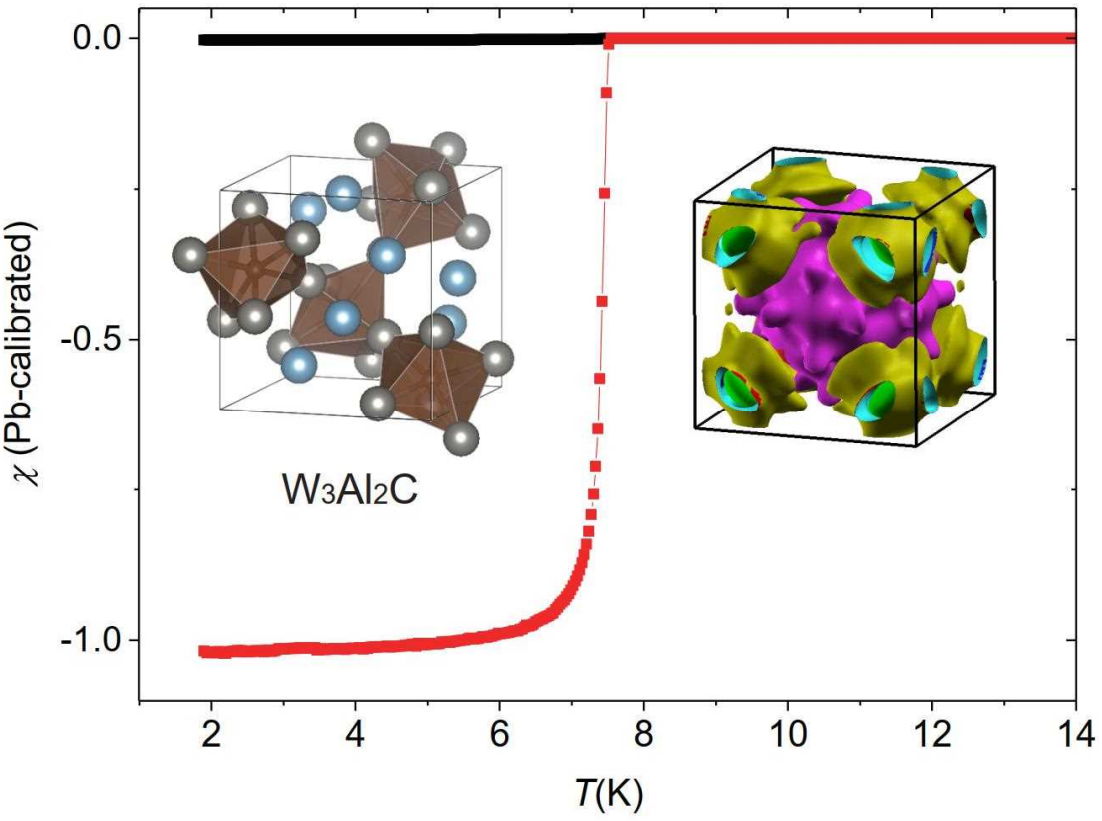
We report the discovery of superconductivity in W_3Al_2C (T_c = 7.6 K) synthesized by high-pressure method. W_3Al_2C is isostructural to Mo_3Al_2C (space group $P4_132$) but with stronger spin-orbit coupling (SOC). Different from the Mo_3Al_2C with metallic nature, the resistivity of the normal state of W_3Al_2C shows a non-metallic behavior. A specific heat jump of $\Delta C_{es}/\gamma T_c = 2.7$ and gap energy of $2\Delta(0)/\gamma T_c = 5.43$ are observed, which are much larger than that of Mo_3Al_2C (2.1 and 4.03) and the expectation of the Bardeen-Cooper-Schrieffer (BCS) theory (1.43 and 3.52). However, the Sommerfeld coefficient of W_3Al_2C is less than half of that of its Mo counterpart and the specific heat below T_c shows a power-law divergence following $C_{es}/\gamma T_c \sim (T/T_c)^{3.3}$ rather than an exponential relation. Theoretical calculations show that the Fermi surface of W_3Al_2C is dominated by W-5*d* electrons and the inclusion of SOC significantly changes its band structure, density of states (DOS) and Fermi surface topology. The realization of superconductivity by replacing 4*d* Mo towards 5*d* W provides a candidate for the search of potential triplet superconductors with enhanced SOC.



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