PCP2-8

Angular dependence of the upper critical field in the high-pressure 1T' phase of $MoTe_2$

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Superconductivity in the type-II Weyl semimetal candidate $MoTe_2$ has attracted much attention due to the possible realization of topological superconductivity. In this work, we constructed a temperature-pressure phase diagram, as shown in Fig.(a). The magnetoresistance (MR) and Hall coefficient of MoTe2 are found to decrease with increasing pressure. The Kohler's scalings for the MR data above ~11 kbar show a change of exponent whereas the data at lower pressure can be well scaled with a single exponent. These results are suggestive of a Fermi-surface reconstruction when the structure changes from the T_d to 1T' phase. We have performed a detailed study of the upper critical field H_{c2} of MoTe2 at 15 kbar, which is in the 1T' phase. The H_{c2}-temperature phase diagram are constructed with magnetic field B // ab and B $\perp$ ab. The data can be satisfactorily described by the Werthamer–Helfand–Hohenberg model with the Maki parameters α ~ 0.77 and 0.45, respectively. The surprisingly enhanced α may stem from a small Fermi surface and a large effective mass of semimetallic $MoTe_2$. The angular dependence of H_{c2} at 15 kbar can be well fitted by the Tinkham model, as shown in Fig.(b), suggesting the two-dimensional nature of superconductivity in the high-pressure 1T' phase. Furthermore, the calculations and experimental results of the electronic structure of $MoTe_2$ under pressure will also be discussed.

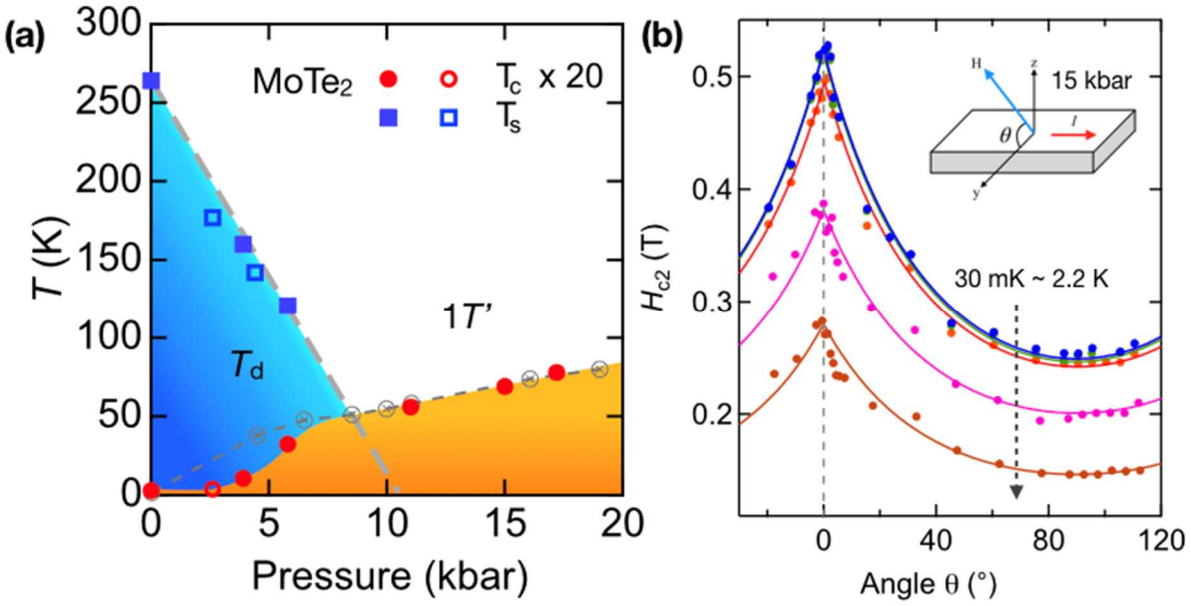

Figure: (a) The temperature-pressure phase diagram of $MoTe_2$. (b) Angular dependence of upper critical field of $MoTe_2$ at 15 kbar. The markers are data and the lines are fitting.

Keywords: Weyl semimetal, Superconductivity, Angular dependence, Electronic structure