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Two-dimensional Mineral [Pb2BiS3][AuTe2]: High mobility Charge Carriers in Single-atom-thick Layers[1] LEI FANG, Department of Chemisty, Northwestern University, J. IM, C. STOUMPOS, F. SHI, V. DRAVID, Northwestern University, M. LEROUX, Argonne National Laboratory, A. FREEMAN, Northwestern University, W.-K. KWOK, D.-Y. CHUNG, Argonne National Laboratory, M. KANATZIDIS, Northwestern University — We report that [Pb2BiS3][AuTe2], known as a naturally occurring mineral buckhornite, hosts 2D carriers in single-atom-thick layers. The structure is composed of stacking layers of weakly coupled [Pb2BiS3] and [AuTe2] sheets. The insulating [Pb2BiS3] sheet inhibits interlayer charge hopping and confines the carriers in the basal plane of the single-atom-thick [AuTe2] layer. Magneto-transport measurements and theoretical calculations show a property of multiband semimetal with compensated density of electrons and holes, which exhibit high hole carrier mobility of 1360 cm^2/Vs. This material possesses an extremely large anisotropy 10^4, comparable to benchmark materials graphite. The electronic structure features linear band dispersion at the Fermi level and ultrahigh Fermi velocities of 10^6 m/s which are virtually identical to that of graphene. The weak interlayer coupling gives rise to the highly cleavable property of single crystal specimens, indicating a prospect for monolayer system.

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