A Novel 2D Zintl Phase with High Carrier Mobility

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Since the discovery of graphene by Andre Geim and Konstantin Novoselov, graphene opens the growing and flourishing field of 2D materials and presents a marvelous opportunity to understand the structure-property correlation. Following the footprints of graphene, alternative layered members are intensively being discovered for a huge diversity of potential applications. Here we have thoroughly investigated the phase transition of the lamellar ZnSb phase. The layered ZnSb phase features weak van der Waals forces in the interlayer region, closely relevant to exfoliation availability. The stacking behaviors of constituent atoms detected by the aberration-corrected STEM images also verify its exfoliatable characteristics. More importantly, the carrier mobility of layered ZnSb (2D) reaches ~468 $cm^2 V^{-1} s^{-1}$ at ambient temperature, approximately 5 times that of the 3D ZnSb analogue. The value is even higher than those of the other typically 2D materials. These results could cast light on discovering novel 2D materials using stepwise topotactic approaches endowed with unpredictable physicochemical properties.