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Giant Rashba spin-orbit splitting in $n-p$ codoped graphene[1]

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Enhancement of the spin-orbit coupling (SOC) in graphene may lead to various topological phenomena and also find applications in spintronics. However, increasing the SOC strength in graphene without drastically affecting the basic physical properties is proving extremely difficult. Here, we propose a new approach, based on compensated $n--p$ codoping, that can simultaneously address all the main shortcomings associated with single-element adsorption in graphene, effectively resulting in giant Rashba spin-orbit splitting. Our proposal is to deposit strong SOC adatoms with outer shell p electrons, acting as n-type dopants, onto already p-doped (e.g., by B) graphene. We found that: (1) the electrostatic attraction between the n- and p-type dopants effectively enhances the adsorption of the metal adatoms and suppress their undesirable clustering, (2) considerable (˜130 meV) Rashba-type SO splitting can be achieved in the graphene π bands, (3) the charge compensated nature and mutually screening each other of the $n--p$ codopants helps to preserve the Dirac nature of the charge carriers, and (4) the B doping effect together with intrinsic induced SOC by adatom also lead the codoped system open about 20 ˜90 meV band gap.

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