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Hole doping problem in Bi_2Se_3 thin films and its solution: Role of interfacial vs bulk defects JISOO MOON, NIKESH KOIRALA, Department of Physics Astronomy, Rutgers, The State University of New Jersey, Piscataway, New Jersey 08854, U.S.A., MARYAM SALEHI, Department of Materials Science Engineering, Rutgers, The State University of New Jersey, Piscataway, New Jersey 08854, U.S.A., SEONGSHIK OH, Department of Physics Astronomy, Rutgers, The State University of New Jersey, Piscataway, New Jersey 08854, U.S.A. — Bi_2Se_3, one of the most widely studied topological insulators, is naturally electron (n-type) doped. In bulk crystals and thick films, n-type Bi_2Se_3 can be converted into p-type through compensation doping. However, such a compensation doping scheme has so far failed to achieve p-type Bi_2Se_3 thin films. Here, we show that there exists a thickness-dependent p-doping problem in Bi_2Se_3 thin films, which originates from the high density of interfacial defects compared with that of the bulk, and provide a solution to this long standing puzzle. Reducing the interfacial defects by employing an effective buffer layer on the bottom and a capping layer on the top, we facilitate the compensation doping scheme and achieved dominant p-type carriers in Bi_2Se_3 thin films down to the thinnest topological regime. Availability of p-type Bi_2Se_3 thin films will open new opportunities in this active field of topological materials.

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