Alloy Contact Engineering for High-Performance p-Type 2D Semiconductor Devices

Amin Azizi
Principal Engineer
TSMC

Abstract

While significant progress has been made for n-type contacts to two-dimensional (2D) materials through various methods, such as doping and selection of appropriate contact metals, the work on p-type contacts have been relatively limited. In this context, we present progress in optimizing p-type contacts via substitutional doping and alloying. By adjusting the dopant concentration from lightly to heavily doped WSe2, we demonstrate degenerate doping densities in bilayer (2L) transition metal dichalcogenide (TMD) alloys. This high level of doping is crucial in reducing contact resistance (Rc) of ultrathin TMDs to metal. We demonstrate a sub-100 $\Omega \cdot \mu$m Rc for bilayer TMD alloys, independent of the gate voltage (Vg), with superior thermal stability compared to conventional semimetal contacts.