Abstract
Two-dimensional transition metal selenides possess fascinating physical properties. However, most as-prepared selenides are small in size and environmentally unstable, which greatly hinder their wide applications in high-performance electrical devices. Here we develop a general two-step vapour deposition method and successfully grow different selenide films with controllable thickness, wafer size and high crystalline quality. In stark contrast to the poor stability of most two-dimensional materials, these selenide films show superior environmental stability even after long time exposure or being heated in air, annealed in vacuum or immersed in aqueous solutions. The superconductivity of grown NbSe₂ film is comparable with sheets cleavaged from bulks, and can well maintain after a variety of harsh treatments. The unique properties of these selenide films can be ascribed to the absence of oxygen during the whole growth process. Such unprecedented environmental stability could greatly simplify devices assembling procedure, and should be of both fundamental and technological significance in developing TMS-based devices with extraordinary performances.