

## Supporting Information (SI)

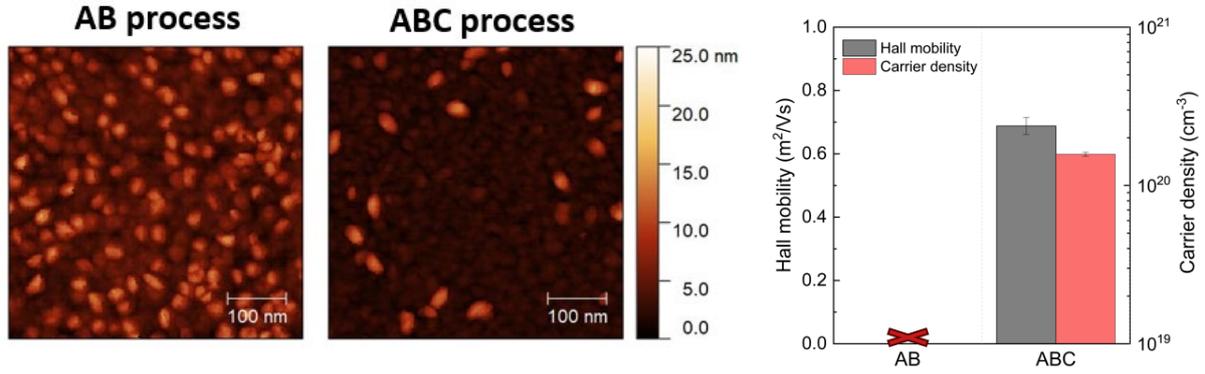


Figure 1: AFM measurements showing the changes in morphology upon using an additional C step to the conventional ALD (AB) process. The Hall mobility and carrier density of AB WS<sub>2</sub> were too low to measure with Hall measurements, while ABC WS<sub>2</sub> ( $p = 15$  mTorr) shows a Hall mobility of  $0.8 \text{ cm}^2/\text{Vs}$  and carrier density of  $1.6 \times 10^{20} \text{ cm}^{-3}$ .

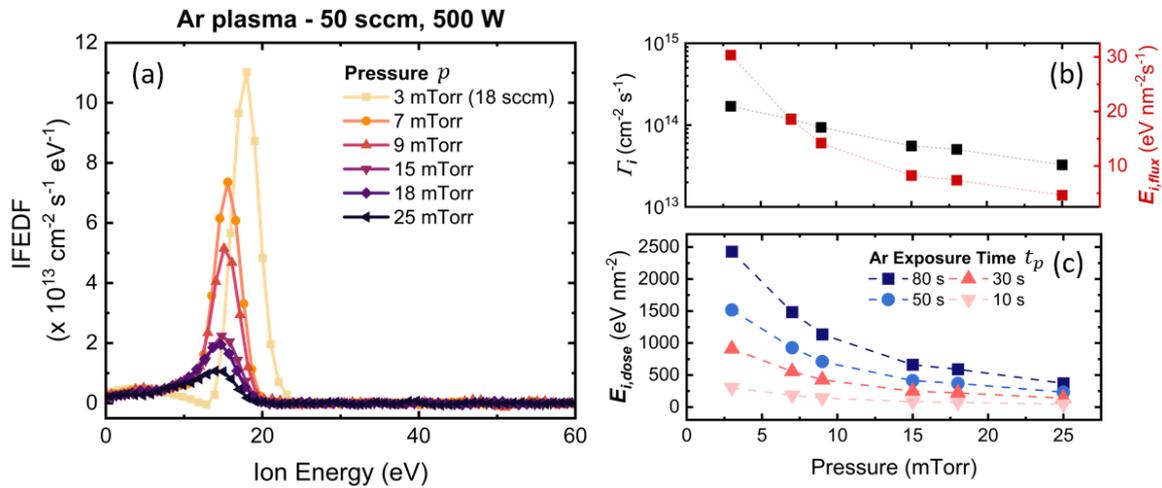


Figure 2: (a) Ion flux energy distribution functions (IFEDFs) measured in an Ar plasma for various gas pressures  $p$  at a power of 500 W and a gas flow of 50 sccm (except for 3 mTorr that is reached with 18 sccm). The IFEDFs have been recorded with a retarding field energy analyzer (RFEA) placed on the substrate table to measure the energy of the ions arriving at the substrate's surface. (b) The total ion flux  $\Gamma_i$  and total ion energy flux  $E_{i,flux}$  and (c) the ion energy dose  $E_{i,dose}$  as function of the Ar plasma pressure  $p$  for various plasma exposure times  $t_p$ .

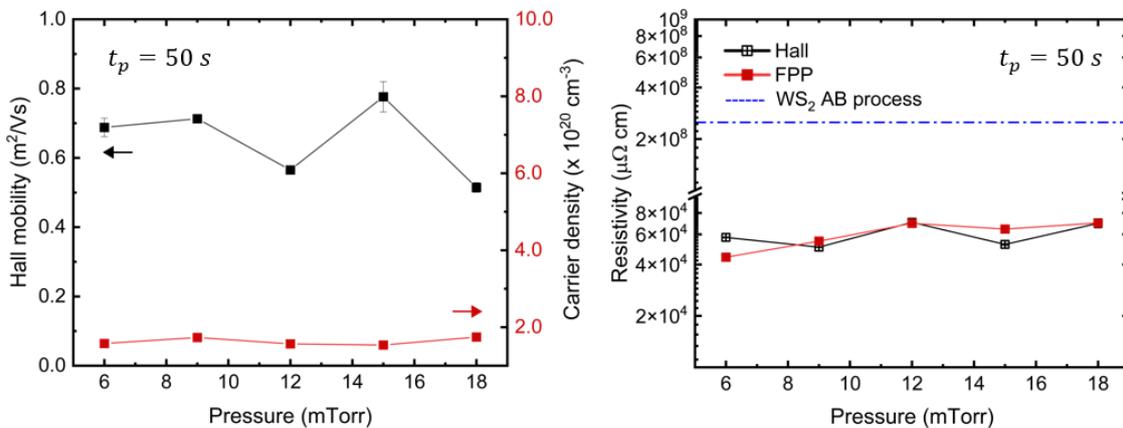


Figure 3: Variation in the Hall mobility  $\mu_H$ , carrier density  $n$  and resistivity  $\rho$  as function of the Ar plasma pressure  $p$  during the C step of the ABC process using  $t_p = 50$  s.