



Extended Data Figure 2 | Growth of single-junction MoSe_2 - WSe_2 lateral heterostructures. a–d, Optical images of single-junction MoSe_2 - WSe_2 monolayer lateral heterostructures with different WSe_2 lateral growth times of 80 s (a), 45 s (b), 30 s (c) and 15 s (d). The inset in d shows the Raman map of the narrow WSe_2 shell, which is difficult to visualize in the optical image. e–g, Composite photoluminescence maps corresponding to optical images in a–c, respectively, at 1.53 eV (MoSe_2 domain) and 1.6 eV (WSe_2 domain). h, Composite Raman map corresponding to the optical

image in d, at frequencies 240 cm^{-1} (MoSe_2 domain) and 250 cm^{-1} (WSe_2 domain). i, Low-magnification optical images of the MoSe_2 - WSe_2 single-junction heterostructure shown in b, obtained at different distances from the source precursor as mentioned in Extended Data Fig. 1b, c (regions II to IV). j, k, Photoluminescence spectra of monolayer (1L), bilayer (2L) and trilayer (3L) heterostructures; MoSe_2 (j) and WSe_2 (k) domains. Scale bars: a–h, 10 μm .