Supplemental File related to PCSI-48 talk: MBE Growth of Transition-Metal Dichalcogenides

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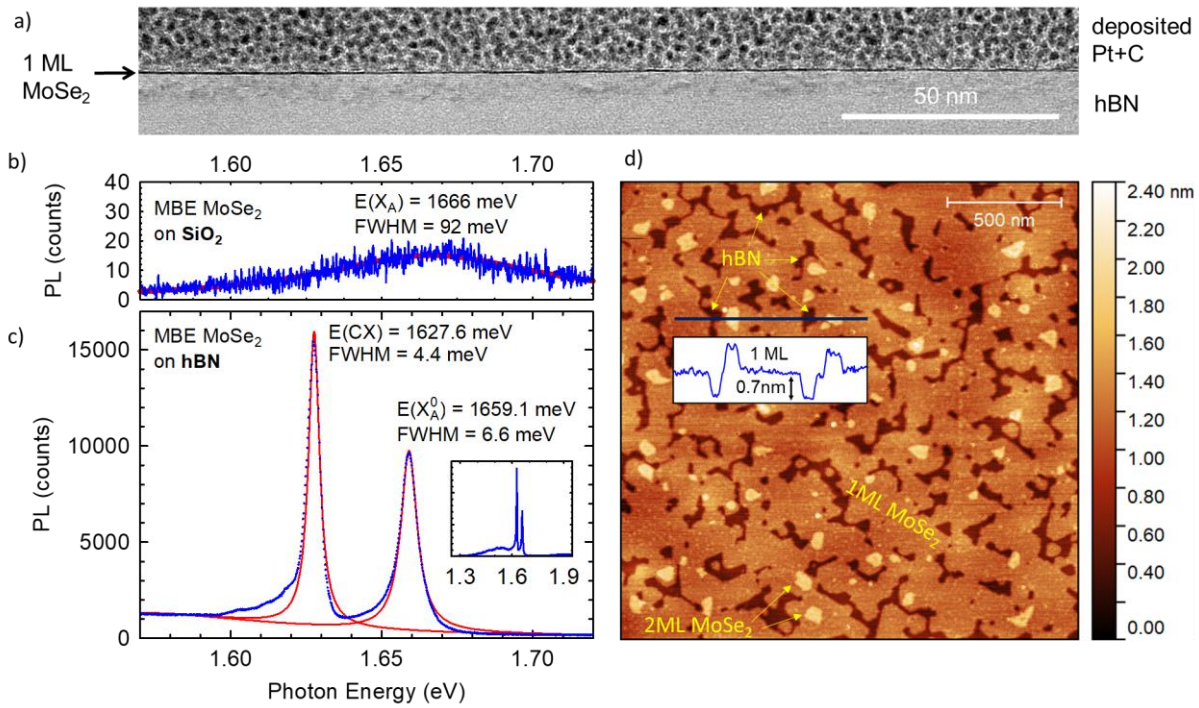

Fig. 1. Narrow excitonic lines presented for the first time for MBE-grown TMD. TEM cross-section of studied $MoSe_2$ monolayer grown on exfoliated hBN is shown in (a). Low temperature (T = 10 K) PL spectra (blue curves) of MBE $MoSe_2$ grown on SiO_2 (b) and hBN (c) both produced in the same growth process. Only for $MoSe_2$ grown on hBN it is possible to resolve neutral exciton line X_{0A} and charged exciton line CX. Red curves show Lorentizan fits with following parameters: 1659.1 meV energy and 6.6 meV FWHM for the neutral exciton of $MoSe_2$ grown on hBN; 1627.6 meV energy and 4.4 meV fwhm for the charged exciton of $MoSe_2$ grown on hBN; and 1666 meV energy and 92 meV FWHM of $MoSe_2$ grown on SiO_2. Insert in (c) shows PL spectrum in wider spectral range. (d) AFM image of the sample shown in (a,c), with the almost complete monolayer, only in a very small part covered by the second layer. Size of the scanned area is 2 µm × 2 µm. The inset shows the height profile with 1 ML and 2 ML of $MoSe_2$ and uncovered hBN. [W. Pacuski et al., Nano Letters 20, 3058 (2020).]

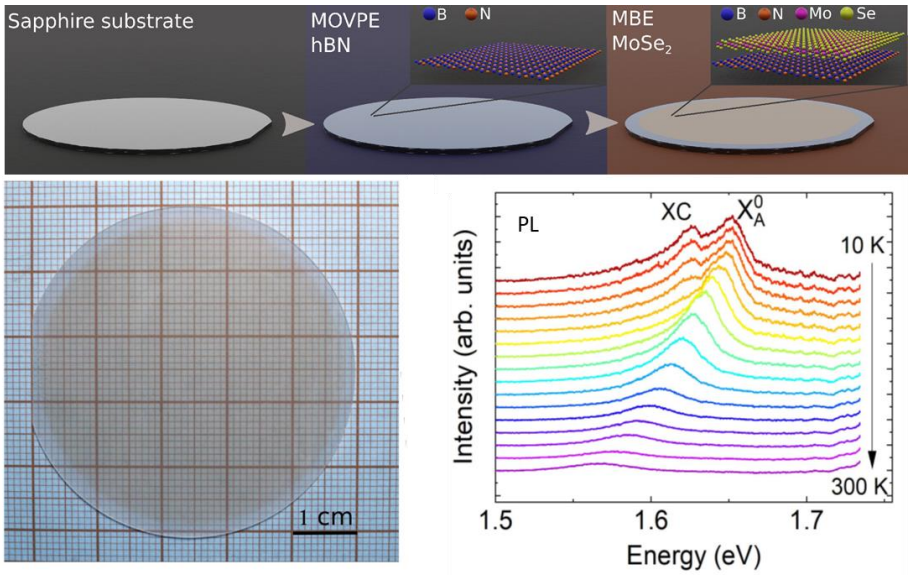

Fig. 2. Scheme of production of wafer with MBE MoSe2 monolayer on hBN buffer and sapphire substrate. Low temperature photoluminescence spectra shows resolved charged exciton and neutral exciton lines. [K. Ludwiczak et al., ACS Appl. Mater. Interfaces 13, 47904 (2021).]

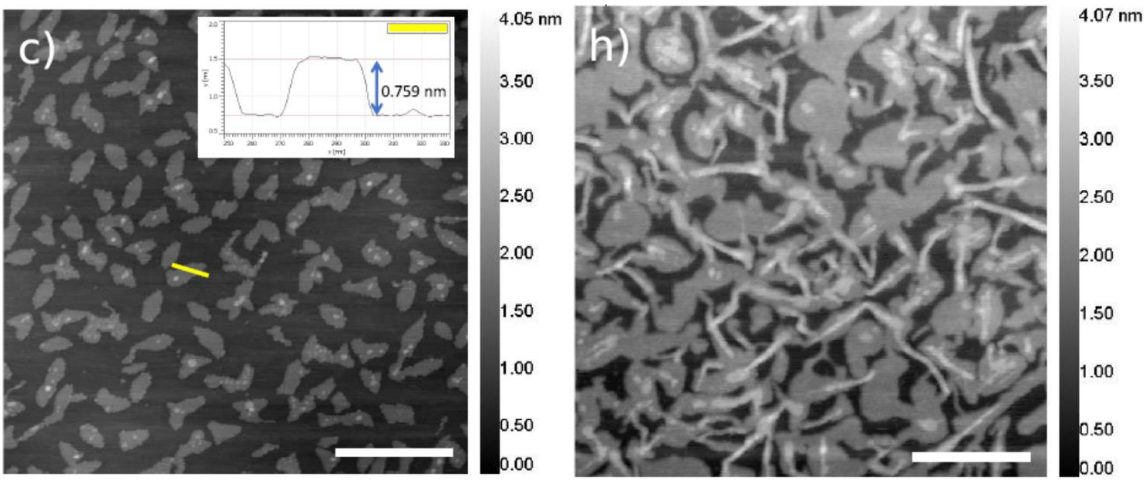

Fig. 3. Examples of $MoTe_2$ grains grown by MBE on hBN substrate. At lower temperatures flat 1 ML thick grains are grown, while at higher temperatures 2D grains are associates with 1D structures identified as Mo_6Te_6. The scale bar corresponds to 500 nm. [B. Seredyński et al., J. Cryst. Growth 596, 126806 (2022).]

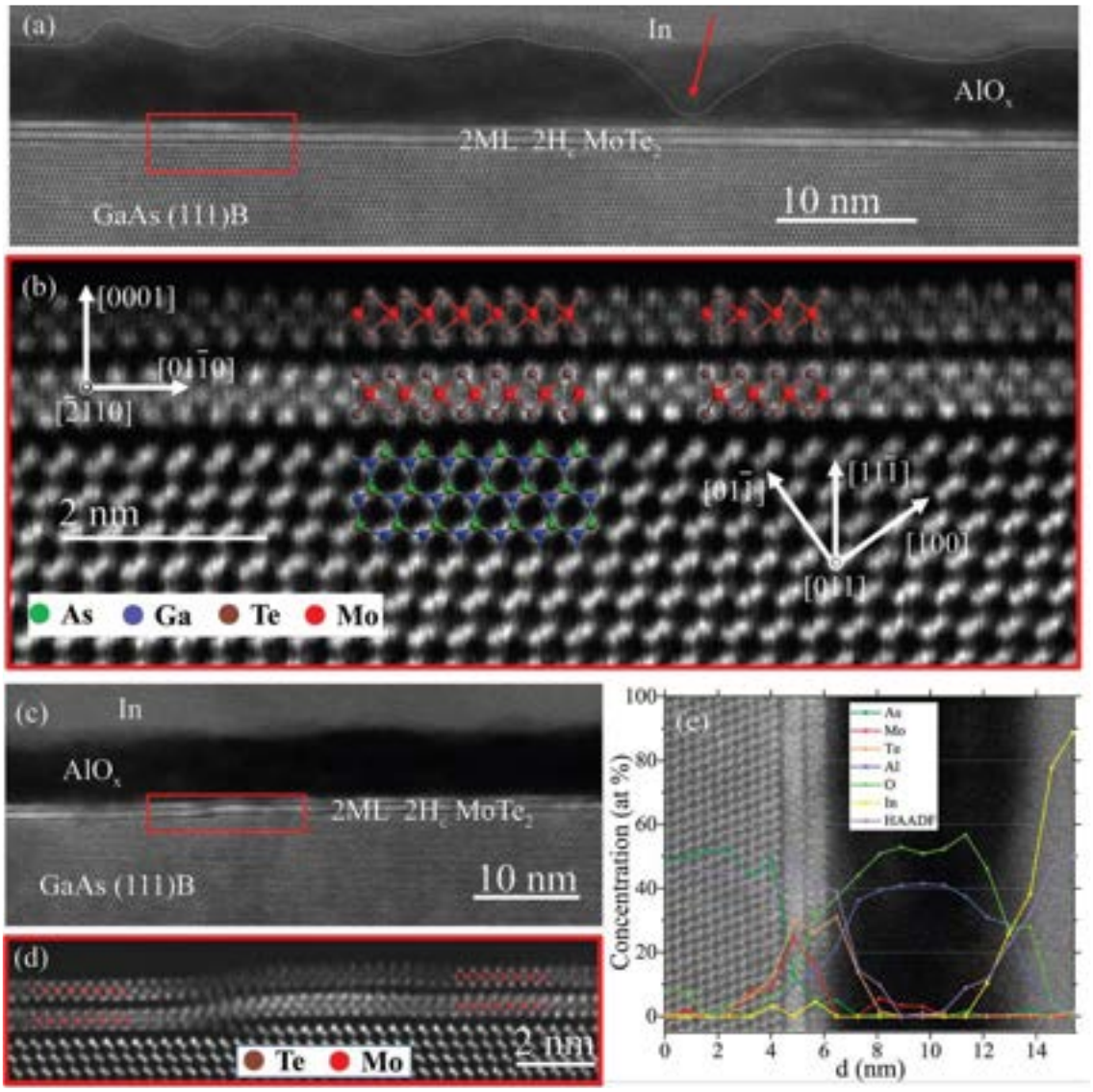

Fig. 4. HR TEM image of $MoTe_2$ bilayer grown on GaAs (111)B by MBE, subsequently protected in vacuum by Al, which transforms in air to AlOx final protection layer. Cross-section is made for are of indium contact prepared for electron transport investigations. [Z. Ogorzałek et al., Nanoscale 12, 16535 (2020).]