Wurtzite MnSe – Epitaxy and Properties of an Altermagnetic Candidate

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A coexistence of a magnetically compensated collinear order and spin-splitting of the bands is a peculiar phenomenon [1] that attracts a lot of attention. It is present in the class of materials, which have been recently called altermagnets [2]. Such behaviour arises from the specific symmetry operations that connect the spin sublattices. We present a novel candidate of this class, semiconductive wurtzite MnSe [3].

We demonstrate experimentally through structural characterization techniques that it is possible to obtain thin films of both the intriguing wurtzite phase of MnSe and more common rock-salt MnSe using molecular beam epitaxy on GaAs substrates. The choice of buffer layers during the growth plays a crucial role in determining the resulting phase of MnSe and consequently extends the array of materials available for the physics of altermagnetism.

We present basic optical properties of structures containing wurtzite MnSe. We show that despite strong photoluminescence of MnSe close to 1.6 eV, this material can be a good barrier for CdSe quantum wells (QW) emitting at higher energies, close to 1.8 eV. Furthermore, we discuss the influence of the built-in electric field present in structures grown on (111) crystalline direction on the energy of emitted light from the QW to explore the possibility to conclude about the magnetic properties of MnSe barrier.

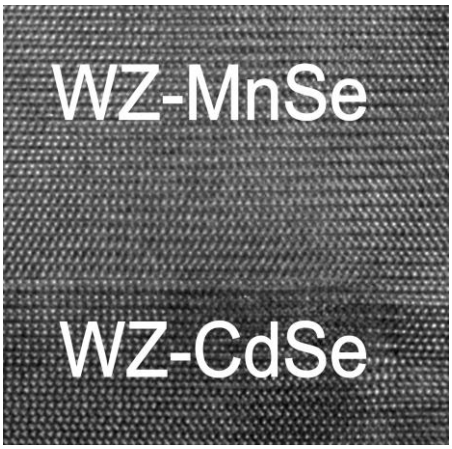

Fig. The scanning transmission electron microscopy analysis for the cross-section of the heterostructure of wurtzite CdSe and wurtzite MnSe.

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[2] L. Šmejkal et al., Phys. Rev. X 12, 040501 (2022).
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