The last few decades have brought a true electronic revolution of enormous significance to our everyday lives. Recently, transparent conducting oxide (TCO) thin films, such as indium tin oxide and cadmium oxide have attracted significant attention because of their simultaneously high transparency in the visible spectrum and low resistivity. In the TCO family, II-VI oxides ternary alloys have attracted the considerable interest of the scientific community due to the possibility of modulating their interesting optoelectronic properties. In this proposal, we would like to explore and broadly characterize new highly prospective and so far poorly tested quasi ternary oxides CdO/MgO and CdO/ZnO. We plan an unusual and innovative approach to the growth of these mixed crystals. We would like to apply and explore alternate growth of MgO, CdO and ZnO thin layers (quasi ternary alloys). Applying an advanced growth method, which is Molecular Beam Epitaxy (MBE), will open up a possibility of growing layers and short-period superlattices (SL), i.e. alternating growth of two or more thin layers of different materials. Basic research on the physical properties of these oxides, by combining the use of many innovative experimental techniques, will allow to significantly broaden knowledge on these perspective materials, which further will open the new avenues for their future application.

The great difference between the growth conditions of the binary compounds CdO, MgO, and ZnO makes the synthesis of CdMgO and CdZnO alloys much more complicated. Thus, growing good quality layers with a composition in the middle of the composition range can be extraordinarily complicated. As it was presented, depending on the growth temperature, a Cd-rich phase, an Mg-rich phase, or both are obtained instead of a single phase with content in the middle of the composition range. It seems that the growth of alternating CdO and MgO thin layers of a given thickness may constitute an innovative and pioneering solution that will allow to control of this problem. New approaches to "ultra-high efficiency" solar cells include devices such as multiple quantum well (MQW) and superlattice systems. These configurations make it possible to improve the spectral response of the cell in the energy region below the absorbing edge of the barrier material.

Basic research and the results of advanced structural, optical and electrical characterization are crucial for bringing out the potential of layers and structures based on CdO/MgO, CdO/ZnO quasi-ternary alloys. Extensively focused research of these new materials is important for the development of semiconductor physics, especially because our current knowledge about these ternary alloys is very limited.

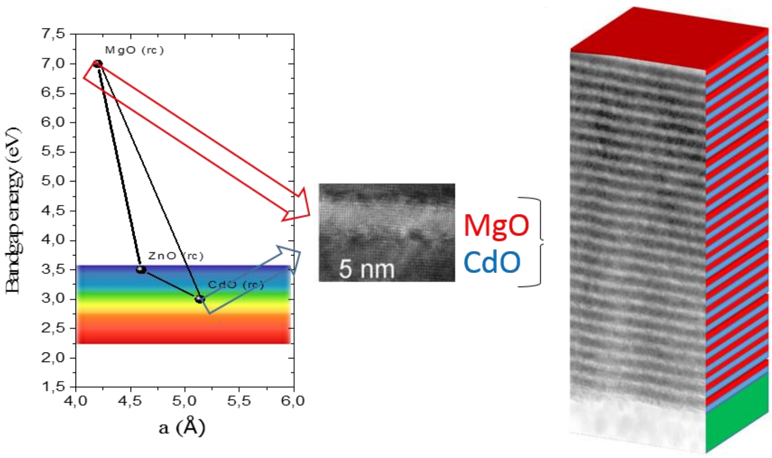

Fig. 1 The possibility of changing the energy gap to deep UV in CdO-MgO compounds thanks to the use of superlattice growth.