Activation of luminescence from wurtzite CdTe nanowires

J. Płachta[1], A. Kaleta[1], S. Kret[1], G Karczewski[1], T Wojtowicz[1,2] , J. Kossut[1] and P.Wojnar[1]

[1]*Institute of Physics, Polish Academy of Sciences, Warsaw, Poland*
[2]*International Research Centre MagTop, Warsaw, Poland.*

Cadmium telluride is most often found in zinc blende structure, however it is possible to obtain it in wurtzite phase. Our previous experience with CdTe nanowires shows, that despite a small fraction of nanowires is indeed wurtzite in most of the samples, the luminescence from those structures was never observed. There are just a few papers on luminescence from wurtzite phase in CdTe, reporting an emission at about 50meV above zinc-blende bandgap[1,2].

In our recent experiments we have grown Au-catalyzed CdTe nanowires using MBE system [3]. Those nanowires are about 2 um long and 35 nm in diameter. In next step we annealed those nanowires in order to decrease their diameter. The annealing was performed in Te atmosphere and temperature about 60°C above growth temperature for 30-40 minutes, then a (Cd,Mg)Te shell was deposited. This process have led to the appearance of a pronounced emission at about 1.65 eV., fig. 1.

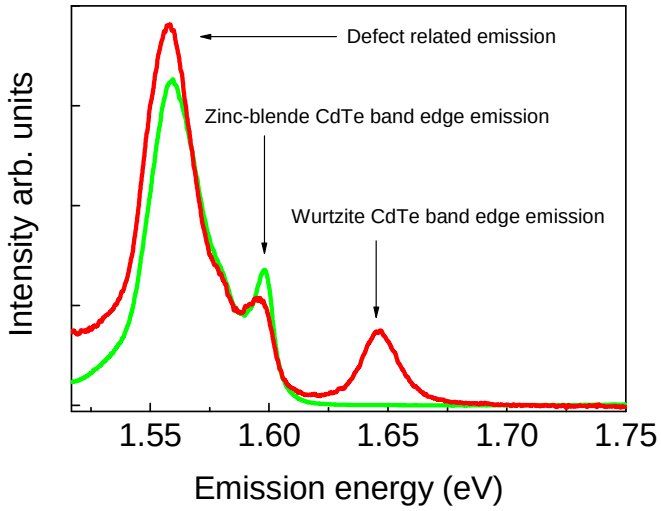

Figure 1: A comparison of emission from a reference sample (green) and annealed sample (red). λ_{ex}=532nm.

To confirm that this emission originates indeed from wurtzite phase, we perform a cathodoluminescence-TEM combined study. All of the structures emitting in higher energy are shown to be wurtzite with many stacking faults.

A micro photoluminescence study of single nanowires was also performed for further characterization. It revealed, that in higher excitation powers a more energetic, perpendicularly polarized state appears, which was not observed for nanowires emitting in 1.6eV. The two states are coming from light and heavy hole bands which are intrinsically split in wurtzite[3].

References:

[1] Pierre Lefebvre et al. PHYSICAL REVIEW B, 53, 15440 (1996)
[2] Bingwei Luo et al. , CrystEngComm, 14, 7922-7928 (2012)
[3] Wojnar P. et al. Nanotechnology 28, 045207 (2016)
[4] D. Spirkoska, PHYSICAL REVIEW B 85, 045309 (2012)

This research was funded from a grant: 2017/25/N/ST3/00621