Nanoscale physics

Mechanical Properties of MBE-Grown Metal Telluride Layers

W. Szuszkiewicz[1,2], S. Adamiak[2], P. Adamski[2], K. Matracki[2], E. Dynowska[1], P. Dziawa[1], B. Taliashvili[1], M. Wiater[1], T. Wojtowicz[1]

[1] *Institute of Physics, Polish Academy of Sciences, Aleja Lotników 32/46,PL-02668 Warsaw, Poland*
E-mail: szusz@ifpan.edu.pl

[2] *Faculty of Mathematics and Natural Sciences, University of Rzeszów, ul. Pigonia 1, PL-35310 Rzeszów, Poland*

The results of microhardness measurements performed on carefully prepared, high-quality, bulk semiconductor wafers demonstrated, that it is possible to get new, valuable information on mechanical properties of investigated materials by a nanoindentation. In particular, it was possible to investigate in detail parameters describing the elastic deformation, the nucleation, generation and motion of dislocations, the process of plastic deformation etc. A clear feature on a load–depth curve illustrating an indentation into a semiconductor – the sudden jump in displacement at a given load ('pop-in' effect) – was often observed. The observation of 'pop-in' effect was recently reported not only in Si and in selected III-V compounds, but also in ZnTe, CdTe or ZnO.

The aim of the present work was to look for similar effects in slightly less known semiconducting compounds: MnTe and PbTe. Several few μm thick ZnTe, CdTe, and MnTe layers with the *fcc* crystal structure of the zinc blende type grown on GaAs substrates by MBE were characterized by SEM, AFM, XRD and investigated by the nanoindentation method. The few μm thick, MBE-grown PbTe layer with the *fcc* crystal structure of the NaCl type was examined by the same methods. In all four cases the 'pop-in' effect was observed and analyzed. The values of parameters describing mechanical properties of investigated compounds (e.g., nanohardness and Young's modulus) were compared with those available from the literature, corresponding to other materials. New information on mechanical properties of metal tellurides could be of importance for the growth and characterization of nanostructures composed of these semiconductors.

This work was partly supported by National Science Centre (Poland) through grant UMO-2014/13/B/ST3/04393.