DSCM 19P MECHANICAL BEHAVIOR AT POINT CONTACT OF $CdGa_2S_4$ AND $CdGa_2Se_4$

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$CdGa_2X_4$ (X: S, Se) semiconductor compounds belong to a class of so-called $A^{II}B^{III}{}_2X^{VI}{}_4$ ordered-vacancy compounds (OVCs) characterized by rather strong anisotropy, nonlinear optical properties and birefringence, which make them suitable for many technological and optoelectronic applications such as solar cells, nonlinear optical devices, narrow-band optical filters, tunable filters and ultraviolet photodetectors.

In spite of extensive investigations of optoelectronic properties of cadmium thiogallate and selenogallate, there are little ones [1] concerning their mechanical behavior. In this study the deformation peculiarities of $CdGa_2S_4$ and $CdGa_2Se_4$ subjected to point contact (indentation) were investigated. By applying a depth-sensing nanoindentation technique with Berkovich pyramidal diamond indenter, the hardness (H) and Young"s modulus (E) were evaluated. The values of H and E show an increase with load decrease (Fig. 1) for both compounds that can be the result of the known indentation size effect. At the same time $CdGa_2Se_4$ demonstrates higher hardness and some lower Young"s modulus comparatively with $CdGa_2S_4$. An additional influence on the drop of hardness with load increase can be induced by the enhanced fragility of materials. The cracking threshold for both $CdGa_2S_4$ and $CdGa_2Se_4$ is about 20 mN, this leading to the modification of load versus penetration depth dependences, which exhibit pronounced expulsion of the indenter from the material as a result of crack growth at the end of unloading (Fig. 2). The enhanced fragility of the materials in study is probably caused by the inner structure possessing a high concentration of vacancies that is known to impede the movement of dislocation and at the same time to give rise to the generation of cracks.

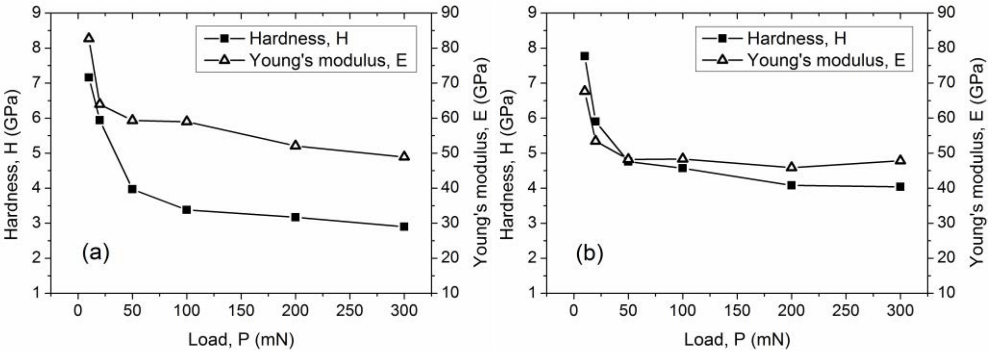

Fig. 1. H(P) and E(P) dependences for $CdGa_2S_4$ (a) and $CdGa_2Se_4$ (b) compounds.

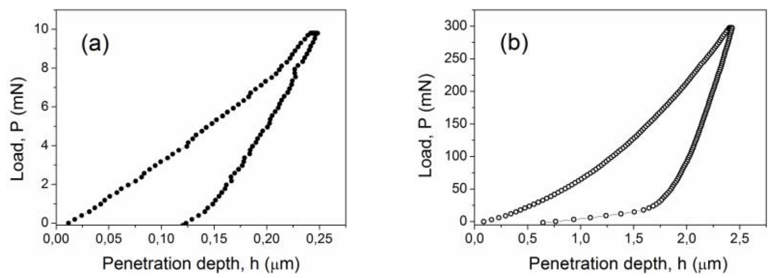

Fig. 2. Indentation curves obtained for $CdGa_2S_4$ by using 10 mN (a) and 300 mN (b) load.

[1] B. Vengatesan, N. Kanniah, P. Ramasamy, *J. Mat. Sci. Lett.* **5** (1986) 987.