Nanophysics and physical and chemical materials science

Investigation of mechanical properties of auxetics from meso- to nanolevels

V.O. Korpan[1], O.V.Lysyuk[1], A.V.Oliynich-Lysyuk[1], M.D. Raransky[1], O.Yu. Taschuk[2]

[1]*Department of Solid State Physics, Yuriy Fedkovych Chernivtsi national university, Str. Kotsyubinskogo, 2, Chernivtsi-58012, Ukraine*.
E-mail: a_oliynich@ukr.net.

[2] *Department of Architecture and Construction Yuriy Fedkovych Chernivtsi national university, Str. Kotsyubinskogo 2, Chernivtsi-58012, Ukraine*.

A set of experimental and theoretical methods including the study of low-frequency absorption of elastic energy, the behavior of dynamic elastic modules, as well as computational modeling [1-3] of deformation processes at various structural levels from “meso” to “nano” at various temperatures, deformation degrees with allowance for relaxation processes is proposed.

Using the example of auxetic beryllium, it has been shown that deformation at various structural levels is due to the movement of both usual dislocation-disclination defects (DDDs) and "auxetic" DDDs with significantly different energy and dynamic characteristics (velocities, braking rates, interaction energies, etc.).

This approach allowed us to explain the experimentally observed anomalies in the absorption of elastic energy and the behavior of the effective shear modulus during cyclic deformation of large-scale crystalline and micro-nanocrystalline beryllium at various temperatures and types of auxeticity.

1. *Oleinich-Lysyuk A.V., Raransky N.D*. Elastic and inelastic properties of open thermodynamically unstable dissipation systems // Physical mesomechanics. -2013. -**16**, №5. -P. 73 - 78.
2. *Raransky M..D., Balazuc V.N., Hunko N.M.* Auxetics phenomenon in solids: Monograph / - Chernivtsi: Print Art. -2016. - 180 p.
3. *Raransky M.D., Oliynich-Lysyuk A.V., Tashchuk O.Yu, Kurek E.I.* Influence of auxetics type on elastic and inelastic features of beryllium // Met. Phys. Adv. Tech. -2016. -**38**, №7. -P. 941-953.