Microsymposium

MS15.O04

Twisted crystals

A. Shtukenberg[1], B. Kahr[1]
[1]*New York University, Department of Chemistry, New York, USA*

Modern reviews on crystal growth and defects in crystals overlook the fact that a significant portion of materials can spontaneously grow as single crystals with twisted and bent morphologies and curved crystal lattices. Twisted crystals can be found among all types of materials (molecular crystals, salts, minerals, high polymers, metals, and elements) crystallizing in any point and space group from all types of growth media (vapor, solution, gel, glass, melt, and solid state). Their size spans over more than six orders of magnitude ranging from nm where 3D character is equivocal, to cm or dm (some of the biggest natural crystals). Here are illustrated most important features of twisted crystals as well as an analysis of mechanisms that are responsible for this mysterious phenomenon [1]. In general, formation of a twisted crystal is a complex phenomenon involving with certain requirements for dissymmetry, isomorphism, and crystal chemistry. Also critical are processes at the crystal-medium interface as well as the elasticity and plasticity of the crystalline medium. As such, twisting is strongly controlled by morphology and symmetry of the growth face. It frequently requires impurities, sometimes in extremely low concentrations. The intensity of deformation is inversely proportional to the crystal size. The phenomenon is more common when the driving force for crystallization and the temperature are high. Several mechanisms have been proposed to explain the formation of unusual curved morphologies: axial dislocation in whiskers (Eshelby twist); surface stress in polymer lamellae; surface charge and spontaneous polarization in nanoribbons; inhomogeneous fields forming around a growing crystal; and internal stress created by an inhomogeneous impurity distribution. However, most of the mechanisms proposed are insufficiently developed and need further verification and elaboration. The work was supported by the US National Science Foundation and New York University.

[1] *A. G. Shtukenberg, Yu. O. Punin, A. Gujral, et al, Angew. Chem. Int. Ed., 2014, 53, 672-699*

Keywords: non-classical morphologies, growth defects, internal stress