Growth of mesoscopic protein/silica crystals by a simple organism

*E. ZOLOTOYABKO

Technion-Israel Institute of Technology, Haifa 32000, Israel (*correspondence: zloto@tx.technion.ac.il)

Synthetic hybrid polymer/silica composites draw increasing attention of researchers due to their potential applications in catalysis, drug delivery, and light-emitting devices. Such hybrid composites are also grown by living organisms, e.g. by glass sponges, whose spicules exhibit complex hierarchical arrangement of stiff (amorphous silica) and compliant (proteins) structural components. Very recently we found amazingly perfect periodic structure of complementary protein and silica lattices within the slender axial filament of the giant anchor spicule in the marine sponge *Monorhaphis chuni* [1]. A 10 nm lattice periodicity has been detected by the focused beam X-ray diffraction and then confirmed by high-resolution TEM. Systematic studies [2] revealed steady lattice rotation (Eshelby twist [3]) along the filament axis due to the presence of screw dislocation. As suggested by Frank [4], this mode of growth utilizes permanent addition of new lattice entities to the surface steps emerging around the dislocation line. This is energetically more efficient than the nucleation of 2D islands on a flat surface and is known to lead to high-quality bulk crystals. The obtained results allow us to better understand how such crystals can effectively grow up to 3m in height at low temperatures of deep water.

[1] Zlotnikov et al. (2014) *Adv. Mater.* **26**, 1682-1687. [2] Zlotnikov et al. (2015) *Small* **11**, 5636-5641. [3] Eshelby (1953) *J. Appl. Phys.* **24**, 176-179. [4] Burton, Cabrera & Frank (1949) *Nature* **163**, 398-399.