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On unified approach in description of crystalline structures in discrete space

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The geometric crystallography offers two ways of looking at the natural dividing of structures into a large number of unit cells. Usually, the crystal is viewed as consisting of "elementary cells", which are repeated by translation of the lattice. An alternative system also divides the crystal in the identical space-filling polyhedra (including different forms), but they do not necessarily represent the translationally-equivalent figures. These areas are called "areas for interaction", "basic configurations". Such regions may be defined in the n-dimensional space. The concept of homogeneous space can be formulated in two cases: continuous infinite space and infinite discrete space. Traditional crystallography is based on the use of X-ray diffraction, which underlines periodicity, but electron microscopy gives a more general form of the order. In these cases we have images in a geometric cross-sections or projections for analyze. We consider the sections and projections as two-dimensional images therefore relevant Penrose's patterns. Two-dimensional Penrose's patterns can be prepared by projection of five-dimensional hyper cubic lattice in the corresponding direction, and three-dimensional patterns can be prepared from a 6-dimensional hypercube lattice. Consequently, the real discrete space has a dimension in which the cross section and the projection are equivalent because projection in one space (real/converted) corresponds to a section in another one (the transformed/real). This explains an existence of large number of "exceptions" from the "classic" spatial concepts of crystallography, including quasicrystals. The investigation of features of nanostate allowed concluding about its structural many fold. This property determines the local character of formation of nanoparticle, and supports the concept of "building blocks" - the fundamental configurations and, therefore, necessity of use of the space of the high dimensions for the description of various nanoparticles. We can now indicate the main problem for the chemistry of the XXI century – how a substance is produced? The place where it is formed - the nanoworld.

Biography

Dr. Vladimir Shevchenko was born on 1947, Smela of the Cherkasy region. In 1963 he graduated from the Physics Department of the Moscow State University. M.V. Lomonosov Moscow State University. In 1977 he defended his doctoral dissertation. Since 1998, he is director of the Institute of Silicate Chemistry named after I. Grebenshchikov of the Russian Academy of Sciences. In 1970s, he analyzed the homological series of inorganic substances and discovered the laws of the "dielectric-metal" transitions (USSR Discovery No. 196). He is headed by the Scientific Council of the Russian Academy of Sciences on ceramic and other non-metallic materials of the Russian Academy of Sciences.

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