Poster Presentation

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Average unit cell for the Generalized Penrose Tiling

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The Generalized Penrose Tiling (GPT) can be considered a promising alternative for Penrose Tiling (PT) as a model for decagonal quasicrystal refinement procedure, particularly in the statistical approach (also called the Average Unit Cell (AUC) approach) [1]. The statistical method using PT has been successfully applied to the structure optimization of various decagonal phases [2]. The application of the AUC concept to the GPT will be presented. In the higher dimensional (nD) approach, PT is obtained by projecting a 5D hypercubic lattice through a window consisting of four pentagons, called the atomic surfaces (ASs), in the perpendicular space. The vertices of these pentagons together with two additional points form a rhombicosahedron. The GPT is created by projecting the 5D hypercubic lattice through a window consisting of five polygons, generated by shifting the ASs along the body diagonal of the rhombicosahedron. Three of the previously pentagonal ASs will become decagon, one will remain pentagonal and one more pentagon will be created (for PT it is a single point). The structure of GPT will depend on the shift parameter, its building units are still thick and thin rhombuses, but the matching rules and the tiling changes. In the AUC concept the probability distribution for rhombuses of PT can be obtained as an oblique projection of the ASs on the physical space. This holds true also for the GPT. The derivation of the AUC distribution for a given type of rhomb in a given orientation of an arbitrarily chosen GPT will be presented. In the PT, these distributions are triangular, whereas in the case of the GPT they are triangular (originating from the pentagonal AS) or hexagonal (originating from the decagonal AS). The AUC of GPT for shift parameters 0.2 and 0.5 has been calculated. The derivation of the analytical formula for structure factor using AUC formalism, for the decorated GPT is made similarly to the calculation for the PT [3].

[1] *J. Wolny, Phil. Mag. 1998, 77, 395-414,* ***[2]*** *P. Kuczera, J. Wolny, W. Steurer, Acta Cryst. 2012, B68, 578–589,* ***[3]*** *B. Kozakowski, J. Wolny, Acta Cryst. 2010, A66, 489-498*

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