Keywords: crystal structures, twinning, intermetallics

FA1-MS02-T05

The System E_8, a Special Class of Simple Polyhedra and Gas Hydrate Structures. Alexander Talis[a], Mikhail Samoylovich[b], Inga Ronova[a], Gennadii Tereschenko[b]. [a]*A.N. Nesmeyanov Institute of Organoelement Compounds, Moscow, Russia.* [b]*Central Research and Technology Institute "TechnoMash", Moscow, Russia*
E-mail: talishome@mail.ru

A possibility to realize ordered solid structures in 3D Euclidean space E^3 is determined to a considerable extent by its topological properties, one of which is the non-integral nature of the maximum number, equal to 5.104..., of regular tetrahedra with common edge. In the end, this allows one to approximate the densest non-lattice sphere packings by statistical partitions into simple (3 edges meet at every vertex) 14-face polyhedra with 4, 5 and 6-edge faces. One of such polyhedra is Kelvin's polyhedron $[4^6, 6^8]$ with six square and eight hexagonal faces that make up the Dirichlet polyhedron for the bcc lattice [1]. The ordered structures in E^3 are considered as Euclidian realizations of the algebraic geometry constructions in accordance to the approach applied in [2]. The 8-dimensional vector (root) system E_8, Mathieu groups M_n and the $PSL_2(11)$ group with the order of 660 [3] are especially significant amongst these algebraic constructions. The set of vertices of $[4^6, 6^8]$ is isomorphic to set of 24 cosets of the group $2M_{12}$ by subgroup M_{11}:

$O_h/C_{1v} \leftrightarrow 2M_{12}/M_{11} = \{g_i\, 2(g_k PSL_2(11)),\ i,k = 1,2 \ldots 12\}$ (1), while its bichromatic graph is determined by the insidence table (IT) 12x12 with the columns as 12 white vertices and rows as 12 black vertices, and 36 incidence signs as 2x18 edges. Due to (1) the 2x2IT corresponds to a subsystem of E_8 from 2(2(2x18)) vectors. Table 2x2IT determines "algebraic polytopes" [2] with 2(2x18) and 2x18 vertices onto spheres in E^4 and E^3 under the condition of transferring to 2IT and IT. The diagonal blocks nxn and (12-n)x(12-n) in the IT are an algebraic significant part of IT and changes (determined by the 2IT) of the signs dispositions in non-diagonal blocks allow to pass to the some IT'. Table IT' (equivalent to the IT by the $2M_{12}$) determines the graph of a simple 24-verticed, 14-faced