

Chapter 2

Higher Dimensions of Clusters of Intermetallic Compounds

ABSTRACT

The author has previously proved that diffraction patterns of intermetallic compounds (quasicrystals) have translational symmetry in the space of higher dimension. In this chapter, it is proved that the metallic nanoclusters also have a higher dimension. The internal geometry of clusters was investigated. General expressions for calculating the dimension of clusters are obtained from which it follows that the dimension of metallic nanoclusters increases linearly with increasing number of cluster shells. The dimensions of many experimentally known metallic nanoclusters are determined. It is shown that these clusters, which are usually considered to be three-dimensional, have a higher dimension. The Euler-Poincaré equation was used, and the internal geometry of clusters was investigated.

INTRODUCTION

A systematic study of the geometry of the structures of chemical compounds (Zhizhin, 2014a, b, c, d, 2016, 2018, 2019a) showed that almost all elements of the periodic system form molecules of higher dimension. It is natural to assume that clusters, as larger than education molecules, including a large number of atoms, can have a higher dimension. However, until recently, clusters considered as three - dimensional objects (Lord, Mackay, & Ranganathan, 2006; Pauling, 1960). This Chapter discusses clusters of real chemical

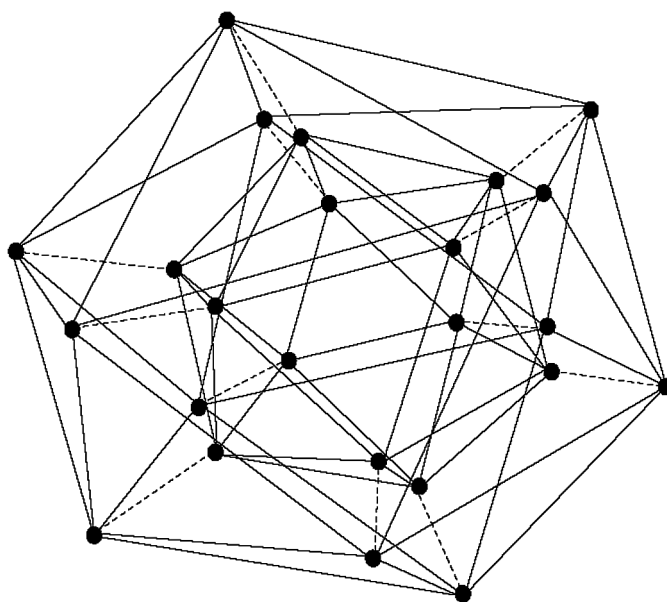
DOI: 10.4018/978-1-7998-3784-8.ch002

compounds (as opposed to the book of Diudea, 2018, in which, as the author emphasizes, clusters are not related to real chemical compounds). Moreover, in this work, consideration of clusters is limited to a special type of chemical compounds - intermetallic compounds, since the study of intermetallic compounds has had a significant impact on the development of scientific views in recent decades. In particular, the discovery of so - called quasicrystals is associated with intermetallic compounds, i.e. crystals supposedly devoid of translational symmetry (Shechtman et al., 1984). Although it was later shown that quasicrystals have translational symmetry, but in the space of higher dimension (Shevchenko, Zhizhin, & Mackay, 2013a, b; Zhizhin, 2014c; Zhizhin, & Diudea, 2016). The ideas about the higher dimension of clusters and the calculation of this dimension should be taken account to in their practical use as objects with valuable physic - chemical properties.

CLUSTERS OF MACKAY

Mackay's cluster consists of two icosahedrons of different sizes with a common center (Mackay, 1962). A larger icosahedron is obtained by attaching a number of tetrahedrons and octahedrons to the surface of the smaller icosahedron.

Figure 1. The cluster of Mackay



25 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/higher-dimensions-of-clusters-of-intermetallic-compounds/261001

Related Content

Role of Nanocomposite Materials for Water Pollution Alleviation Technologies

Nisha Sharma, Mithu Maiti Jana and Shweta Singh (2023). *Implications of Nanoecotoxicology on Environmental Sustainability* (pp. 55-75).

www.irma-international.org/chapter/role-of-nanocomposite-materials-for-water-pollution-alleviation-technologies/318953

Simple Collision-Based Chemical Logic Gates with Adaptive Computing

Rita Toth, Christopher Stone, Ben de Lacy Costello, Andrew Adamatzky and Larry Bull (2009). *International Journal of Nanotechnology and Molecular Computation* (pp. 1-16).

www.irma-international.org/article/simple-collision-based-chemical-logic/4081

Mining a Nanoparticle Dataset, Compiled Within the MODENA-COST Action

Sabine Van Miert, Jan Creylman and Geert R. Verheyen (2021). *Research Anthology on Synthesis, Characterization, and Applications of Nanomaterials* (pp. 1706-1724).

www.irma-international.org/chapter/mining-a-nanoparticle-dataset-compiled-within-the-modena-cost-action/279215

Numerical Study of Nanocomposites for Energy Applications

Siddhartha Kosti (2021). *Research Anthology on Synthesis, Characterization, and Applications of Nanomaterials* (pp. 656-684).

www.irma-international.org/chapter/numerical-study-of-nanocomposites-for-energy-applications/279170

Quantum Confinement Modeling and Simulation for Quantum Well Solar Cells

Laurentiu Fara and Mihai Razvan Mitroi (2014). *Nanotechnology: Concepts, Methodologies, Tools, and Applications* (pp. 731-741).

www.irma-international.org/chapter/quantum-confinement-modeling-and-simulation-for-quantum-well-solar-cells/102041