Carbon Structures and Trivalent Discrete Surfaces

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In the last two or three decades, new carbon structures, Fullerens (C60), Carbon Nanotubes, Graphene. are founded. These are sp^2 structures, that is, mathematically, these are regarded as trivalent graph networks. Moreover, each carbon structure lies on a surface: C60 lies on a sphere, single wall carbon nanotubes lie on a cylinder. From a geometric view point, we may regard C60 as positively curved structure, and single wall carbon nanotubes and graphene as flat structures. Therefore, a natural question is arisen: "Is there a carbon structure which is regarded as negatively curved?" In 1991, Mackay and Terrones proposed a carbon (crystal) structure which lies on Schwarz P surface. Since Schwarz P surface is a triply periodic minimal surface, Mackay-Terrones' structure is regarded as negatively curved.

In this talk, we discuss negatively curved sp^2 carbon structures from geometric view points.

1. Construction of new physically stable negatively curved sp^2 carbon structures by using "standard realization" of crystal structure. The standard realization of a crystal structure is the most symmetric placement among given abstract graph structures.

2. Definition of Gauss and minimal curvature of trivalent discrete surfaces (mathematical model of sp^2 carbon structures) and subdivision of them. This definition gives us that Mackay-Terrones' structure is really negatively curved.

References

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