Chapter-13

ISBN: 979-8588879668

Silicene: A potential 2D nanomaterial

Subhasmita Mishra

Centurion University of Technology and Management, Odisha

Email id: subhasmita.mishra@cutm.ac.in

13.1 Introduction

Nanomaterials are gaining decent attention for several decades. The structural changes from bulk to nano lead to changes in electric, magnetic and mechanical properties, etc. This makes the nanomaterial highly impactful for the usage in various industries. More specifically the 2D nanomaterials are in a multidirectional growing phase embedded with various industrial applications [1,2]. The discovery of carbon allotrope graphene with appreciable exotic properties in 2004 tempted similar expectations from Silicon and Germanium [3-6]. Since carbon, silicon and germanium belong to the same group in the periodic table but differ by the hybridization, where the former one consists of sp^2 and the latter two show sp^3 hybridization. Silicene is an allotrope of silicon with a two-dimensional hexagonal honeycomb structure like graphene. However, the structure of silicone is not exactly flat like graphene but periodically buckled [7-10]. This highlights the coupling strength between the layers in silicone, which is stronger than graphene. Unlike graphene oxide, the oxidized forms of silicone possess a quite different chemical structure. Similar to graphene, the massless Dirac fermions around the K points in the Brillouin zone in the silicene possesses a Dirac, which controls the electronic behavior. A lot of theoretical work has been done on the nature and growth of silicene on different substrates. However, the density functional theory (DFT) and molecular dynamics (MDS) calculations persist in a prediction for the free-standing silicene. But very few experimental works have been explored in this direction. Thus, the field of one and two-dimensional nanoforms of silicon is becoming an emerging research area, which needs to be improved with more experimental visualization to shed light on its advance commercial applications. A schematic diagram for the nanostructure of silicene is provided in Fig.13.1.