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Wide Antimonene Nanoribbon's Electronic Transport Characteristics can be Adjusted by Edge Hydrogenation and Oxidation

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Introduction

The intriguing possibility of implementing diverse applications from two dimensional materials is presented by recent advancements in synthesis and nanofabrication technology. Flexible heterostructure construction using a variety of materials is a ground-breaking innovation [1]. These 2D heterostructures are intriguing prospects for new device designs in the areas of integrated circuits and quantum sciences, and they play a significant role in research of semiconductor and condensed matter physics. Both theoretical and experimental research has concentrated on lateral 2D heterostructures, which are thought to be more easily integrated into planners and to have special electrical and photo electronic capabilities. The features of lateral heterostructures with homogeneous and heterogeneous connections, where the homogeneous junctions share the same host materials and the heterogeneous junctions are mixed with different materials, are outlined in this paper. After that, we go over lateral 2D heterostructure applications and experimental synthesis [2].

Description

A viewpoint on lateral 2D heterostructures is provided in the conclusion has unusual physical characteristics, which include broad-band optical absorption, high mechanical strength, high thermal conductivity, and high charge carrier mobility. As interest in studies of monolayer materials with honeycomb structures as fascinating as graphene grows, a new area of study known as two-dimensional materials is birthed [3].

Other materials besides graphene, such as hexagonal boron nitride, transition metal chalcogenides, black phosphorus, and silicone are thoroughly explored due to their unusual characteristics and associated potential applications. Heterostructures have been studied theoretically and experimentally in comparison to monolayer 2D materials, and their novel customised properties provide a wide range of possible uses. Vertical 2D heterostructures made up of various single layers exhibit certain innovative electrical and optical properties that can be exploited to create transistors and photo electronic devices, such as excellent carrier mobility and perfect photo response performance. In contrast to vertical stacking structures, functional devices are also built using lateral stitching structures in the monolayer plane.

Numerous devices made with lateral heterostructures have showed greater performance or special characteristics. On the basis of monolayer heterojunctions, huge open-circuit voltage and short-circuit current of improved solar devices, high-mobility field-effect transistors, diodes with big rectification behaviour, and inverters with substantial current gains have been demonstrated [4]. It has been demonstrated that a Jones-based photodetector. Both the common emitter current gain and the negative differential resistance phenomenon were seen in 2D bipolar transistors based on lateral heterojunctions. How to tune the properties by structure has emerged as a major concern for researchers because a light emitting device designed with lateral heterostructure demonstrated a larger conversion efficiency of the ratio of the emitted photon to the injected carriers in order to realise more controllable device functions. How durable heterostructures are Examples of effective approaches to change the characteristics include stack sequencing, doping, and various shapes. Vertical heterostructures with the 2D materials woven together flawlessly in a panel [5]. The isolated atomic component can be put together in vertical heterostructures to create new layered materials that are stacked in a carefully chosen order. Vertical heterostructures often use van der Waals interaction to join the several layers. Due to the comparable structure and little lattice mismatch, different 2D atomic panels in lateral 2D heterostructures are sewn together in a single atomic layer.

Conclusion

When combining two different 2D materials, the chemical bonding between the margins of the panels is crucial. The contact is typically weaker than chemical bonding. The synthesis of the two types of heterostructures differs noticeably due to the varied combination strengths of the two types of heterostructures at the interface. The fabrication of the vertical heterostructure using mechanical exfoliation and mechanical transfer procedures is successful due to weak contact, making them some of the hottest study areas in recent years. The performance of 2D devices based on vertical heterostructures is, however, limited by two fundamental problems: contamination between layers and stacking orientation brought on by the stacking process. Lateral heterojunction was suggested as one of the strategies to get around these restrictions. In comparison to vertical transistors based on graphene, improved intrinsic performances have been demonstrated. The two panels can be seamlessly sewn together to provide a crisp interface, and they are synthesised via direct growth. The kind and positioning of the inner

Conflict of Interest

None.

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