Growth and properties of GaAs nanowires on graphene

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Interest in semiconductor nanowires (NWs) ranges from fundamental physics of their growth, transport and optical phenomena to many promising applications in nanoelectronics and nanophotonics [1]. NWs are usually grown via the so-called vapor–liquid–solid mechanism on the surfaces activated by the metal catalyst particles. Due to their ability to stress relaxation, NWs are promising for monolithic integration on the various dissimilar substrates. In this context, one of particular interest is direct synthesis of semiconductor NWs on the graphene. This approach could provide substantial cost-savings in terms of replacing the costly single-crystalline semiconductor substrates and opens up the possibility for a wide variety of hybrid devices, where both of NWs and graphene unique properties can be exploited. [2]. Nevertheless, despite much progress made in recent years, there are still many challenges both on the controllable growth and on the device fabrication, which have to be clarified.

In present work, we present a study of the growth of GaAs nanowires (NWs) on hybrid graphene/SiC substrates by means of molecular beam epitaxy, correlating structural and optical measurements. We demonstrate that Au-seeded GaAs NWs can indeed be grown directly on graphene. The nanowires formed exhibit a tapered morphology and demonstrate interesting crystal structure of alternating wurtzite (WZ) and zinc blende (ZB) segments. The photoluminescence studies of single NWs reveal the existence of quite narrow emission peaks, which range from 810 to 900 nm depending on the thickness of segments in the WZ/ZB heterostructure. In addition, the electrical conductivity of such hybrid system is discussed.

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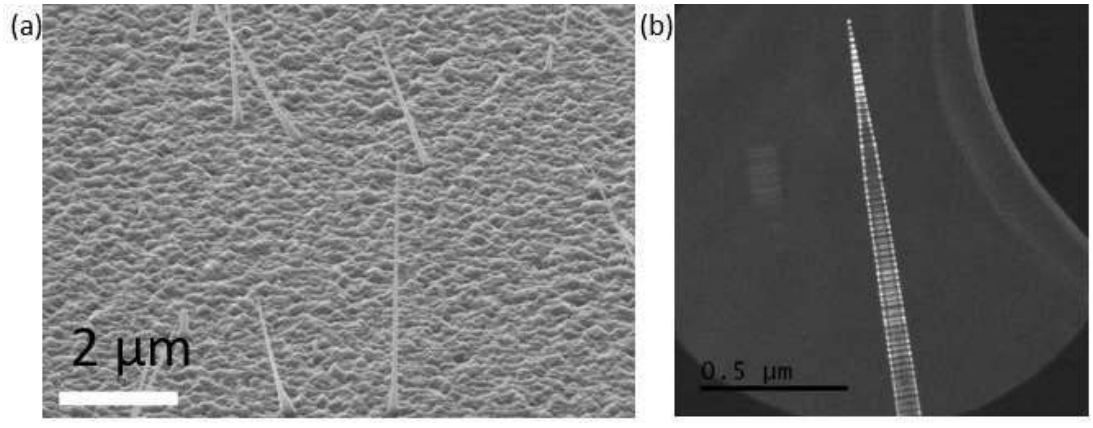

Figure 1. (a) SEM images of GaAs NWs grown on graphene, (b) WZ-ZB twinned crystal structure of GaAs NWs

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[2] A. M. Munshi and H. Weman, *Phys. Status Solidi.* ***7***, 10, (2013).