Investigation of giant step-bunching occurrence during graphene growth on 4H-SiC (0001) in low pressure Ar-H_2 mix gases

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Our group have recently optimized a reproducible and controlled growth process of a monolayer graphene on SiC (0001) at low Ar pressure (10mbar) [1]. We highlight that such process is compatible with electronic applications hence no transfer is needed. The graphene samples obtained using this process have a mobility up to 2000 $cm^2V^{-1}s^{-1}$, at room temperature, which corresponds to the state of the art on similar substrates [2]. One way to enhance the graphene's mobility is by reducing the steps density on the surface. These steps with different surface energies have different step velocities and therefore the steps are preferable to be bunched together aiming to minimize the total surface energy during the thermal treatment [3]. This step bunching often occurs during epitaxial growth of graphene on SiC. The height and width of the steps depend on various factors, such as, polytype of SiC, miscut angle [4] and growth conditions [5]. In this study, we have investigated the etching of 4H-SiC (0001) by H_2 and the occurrence of giant step bunching (GSB) in Ar-H_2 mix gases system at low pressure (10 mbar). The first results show a clear effect of H_2 on the formation of giant steps. The surface of the samples grown under Ar-H_2 environment have a homogeneous distribution of well-aligned steps with terraces width up to 20 µm (figure 1).

References

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Figure

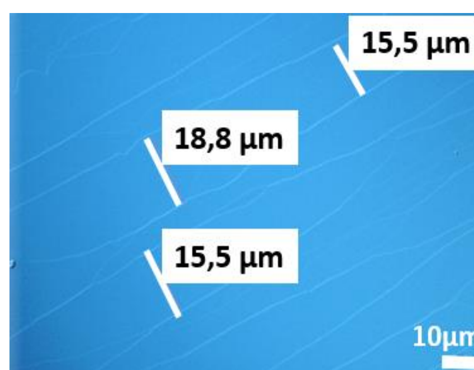

Figure 1: Typical optical image of 4H-SiC sample, after thermal annealing under Ar-H_2 environment, showing large steps. To obtain this image, differential interference contrast (DIC) was used to enhance step edges.