Graphene assisted III-V epitaxy towards substrate recycling (Poster)

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Nowadays, solar cells based on III-V materials are the most efficient but also the most expensive because the growth of III-V materials needs to be done epitaxially on expensive monocrystalline wafer (like Ge or GaAs substrate). The cost of the monocrystalline substrate can go up to 80% of the solar cell production cost[1]. In order to reduce this share, we explore here a new strategy to recycle these costly substrates using a graphene interlayer before the growth of III-V material as described on **Figure 1**. Due to weak Van Der Waals bonds at the graphene layer plane, it is possible to transfer the epitaxially grown III-V material on the host substrate for the following solar cell process.

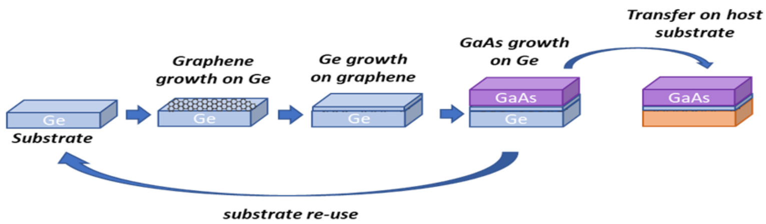

Figure 1: Recycling process of Ge substrate

Firstly, in this work, the growth of GaAs on germanium (Ge) by molecular beam epitaxy was studied. It was found that the use of mis-cut Ge is not a sufficient condition to suppress antiphase domains (APDs)[2]. Growth conditions also play a critical role. The use of migration enhanced epitaxy at low temperature is a key step to avoid atoms diffusion (Ge, As) and obtain smooth surface[3]. After optimizing the growth parameters, atomic force microscopy reveals a smooth surface with an average roughness of 0.7 nm without APDs.

Previous studies in the lab have been shown that during the III-V growth on graphene layer, there is no interaction though the graphene layer to provide single crystals while the growth of III-V from seeds exposed through graphene holes provides a well-defined epitaxial crystal[4]. The second part of this presentation will be devoted to the growth of graphene with holes on Germanium. The growth of graphene on Ge(100)-6° formed shills and valley facets along $[\bar{1}10]$[5]. The growth conditions were studied in order to establish a relationship between graphene coverage and growth time.

References

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