

# Growth Study of CVD Graphene on C-Plane Sapphire – Effects of Substrates and Precursor Flow

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2D materials have stimulated research and innovation by co-integration with CMOS chips, which opens up new fields of application in the areas of “More Moore” and “Beyond Moore” to overcome the scaling issues and reduce energy consumption [1]. Graphene, as a unique semi-metal material, has attracted numerous researchers to explore its properties due to its ultra-high carrier mobility near Dirac cone [2][3]. Since the first deposition of single layer graphene (SLG) on copper via chemical vapor deposition method [4], the growth mechanism of graphene on copper is well studied. The quality of graphene layer on copper makes great achievements in the last ten years [5]. However, the copper contamination issues can not be avoided by growth on such substrate. Therefore, the growth of graphene on c-plane sapphire is an option to achieve the CMOS compatibility. The growth mechanism of graphene on c-plane sapphire is still not well understood. The growth behaviours of graphene, the effects of substrates and precursor flows need to be investigated.

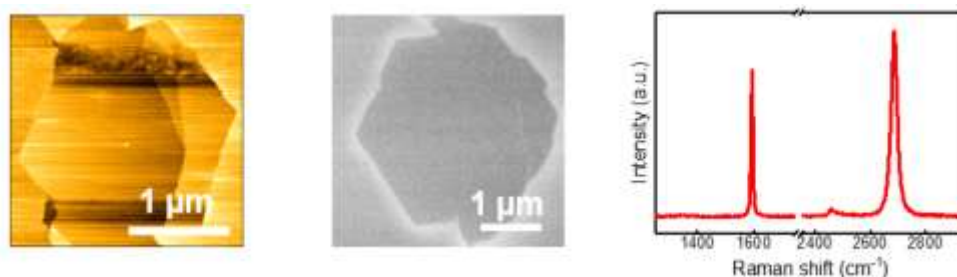
In this work, the graphene was deposited on 2-inch c-plane sapphire in a commercial CCS 7x2" showerhead cold-wall reactor from AIXTRON. The flow of CH<sub>4</sub> and H<sub>2</sub> was optimized to improve graphene quality. The comparison of SLG on c-plane sapphire with different off-cut angle (C/M 0.2°, C/M 0.1°, C/A 0.1°) is shown. Raman mapping shows micrometre regions with almost no D peak. The carrier mobility is characterized by transport measurement. The mobility of graphene reaches up to 4300 cm<sup>2</sup>/Vs at room temperature for centimetre-sized sample. Hexagonal shaped graphene domain with almost no defect peak in Raman can be observed on c-plane sapphire in the Figure below. Understanding of substrate and growth parameter effect is vital for high-quality graphene deposition.

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## References

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## Figures



**Figure:** AFM and SEM image of single graphene grain on c-plane sapphire and its Raman spectrum without D peak