Substrate material study for the growth of Multi-Layer Graphene Nano-Walls

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Abstract

Multi-layer graphene nanowalls (MLGNWs) can be grown on any type of substrates without catalyst as long as the substrate can sustain the growth temperature, which is typically between 600-800°C. Among the several deposition techniques for synthesizing MLGNWs films, ICP-CVD is one of the most promising techniques because of its potential for low temperature synthesis. Plasma growth of graphene provides a rich chemical environment, including a mixture of radicals, molecules and ions from a simple hydrogen-hydrocarbon feedstock thus allowing for lower deposition temperatures and faster growth. The MLGNWs initial growth contains at least two nucleation stages. The first nucleation provides a buffer layer formation, which is one of the main prerequisites for getting a good quality MLGNWs with significant growth rate. This first buffer layer usually contains a high number of defects like amorphous carbon, which depend on the substrate material. After the formation of the first buffer layer, secondary nucleation and vertical alignment of graphene nano-sheets occurs, which is similar for all types of substrates. A slight change in some of the processing parameters (gas composition, precursor gas flow, temperature, pressure and plasma power) can alter the first nucleation process, but has no effect on the second nucleation.

References

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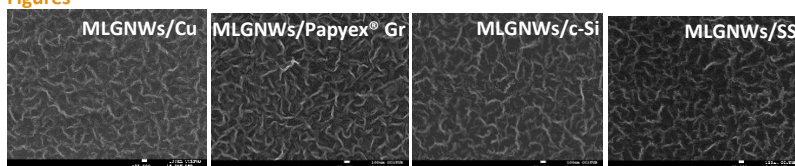
Figures

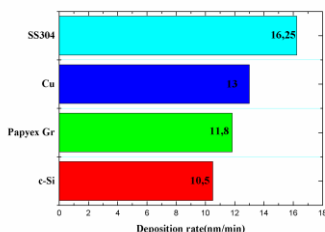**Figure 1:** SEM images of MLGNWs grown on various substrates(Cu foil, Papyex® Gr, c-Si and SS 304)

Figure 2: Deposition rate for different substrates