# Investigation of graphene growth on platinium by chemical vapor deposition

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## Abstract

The use of Cu as a metal catalyst for chemical vapor deposition (CVD) growth of graphene is a well-matured technique to produce homogeneous polycrystalline single layer graphene in large area. However, it has one fundamental issue related to the contamination of graphene by Cu. The relatively low melting temperature (1084 $^{o}$C) of Cu accompanied with its high sublimation at the graphene growth temperature (T = ~ 1000 $^{o}$C) makes this issue almost unavoidable. It could pose a big challenge in integrating the CVD grown graphene into front-end Si device fabrications or when used as an epitaxial substrate for III-V semiconductor growth, which require a strict control on the purity of graphene without any metal contamination [1,2].

Here, we report the CVD growth of graphene with Pt as a metal catalyst. Pt has a melting temperature of ~680 $^{o}$C higher than Cu and an almost zero vapor pressure ($1.3\times10^{-14}$ mmHg) compared to Cu ($6.0\times10^{-5}$ mmHg) at T = 1000 $^{o}$C. Therefore the as-grown graphene is expected to have negligible contamination of Pt.

Various Pt substrates such as Pt films deposited by e-beam evaporation and sputtering, as well as polycrystalline Pt foils have been used to investigate the CVD growth of graphene. It is found that a high temperature sputtering gives highly (111)-oriented Pt and maintains a continuous thin film form without any significant de-wetting of Pt during the graphene growth, which is not the case with e-beam deposited Pt. It is also found to be effective in minimizing the C segregation that leads to a formation of micro-sized multilayer graphene islands which is typically observed in graphene grown on polycrystalline Pt foil [3]. Thus these attributes enable us to grow homogeneous single layer graphene on high temperature sputtered Pt films with a thickness down to 25 nm [4]. Micro-Raman and electron backscatter diffraction (EBSD) mappings on as-grown graphene on sputtered Pt film and polycrystalline Pt foil show differences in physisorption strains depending on the orientation of the Pt surfaces.

## References

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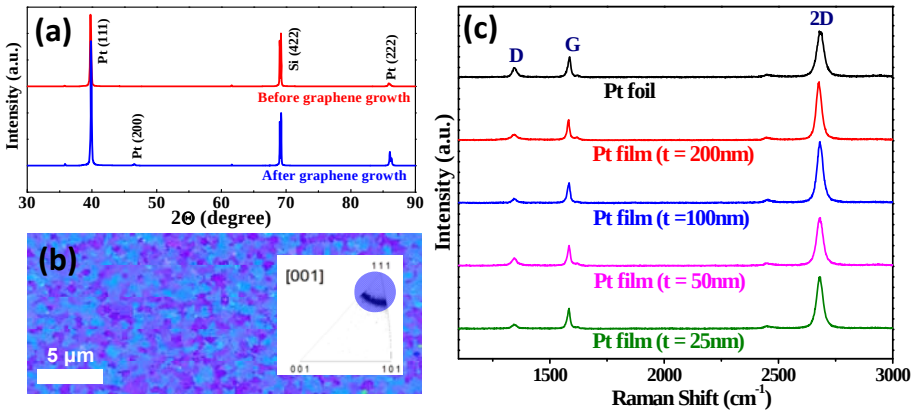


Figure. (a) X-ray diffraction pattern of high temperature sputtered Pt film with a thickness (t) of 100 nm before and after the CVD graphene growth. (b) EBSD mapping of the 100 nm Pt film. (c) Raman spectra of graphene grown on Pt foil and sputtered Pt films with different thickness (t = 25, 50, 100, and 200 nm).