

Role of Intrinsic Carbon in Copper on the Spontaneous Nucleation of Graphene Flakes During Chemical Vapour Deposition

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Abstract

Growth of graphene on copper (Cu) by the chemical vapour deposition (CVD) method is a multidimensional process [1]. Therefore, to achieve a reproducible and optimized growth recipe, a comprehensive understanding of the parameters involved in this process is essential. However, due to the very low solubility of carbon in copper, the growth of graphene on copper has been considered as a pure surface-based process for many years [2, 3].

In our recent work, we studied the role of intrinsic carbon in the bulk of Cu on the growth of graphene on Cu and explicitly disclosed that the nucleation of graphene on Cu foil in CVD is not a pure surface process [4]. We noticed that, due to a hydrogen-assisted carbon depletion effect, carbon content within Cu bulk diffuses out and become a critical parameter in the nucleation of graphene crystals (Figure 1). Therefore and for the first time to our knowledge, we managed to illustrate either spontaneous nucleation of graphene flakes or growth of a graphitic film on Cu foil during annealing in the absence of external carbon sources. This finding can explain the origin of inconsistent growth results from the same replicated recipes in different laboratories and therefore, elucidates the nucleation mechanism of graphene on Cu in the CVD process.

References

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Figures

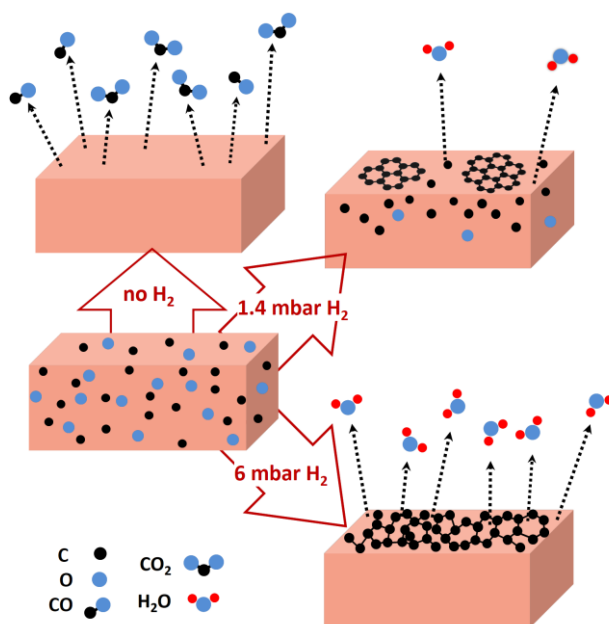


Figure 1: Effect of H-assisted C depletion mechanism on copper foil under various H₂ concentrations.