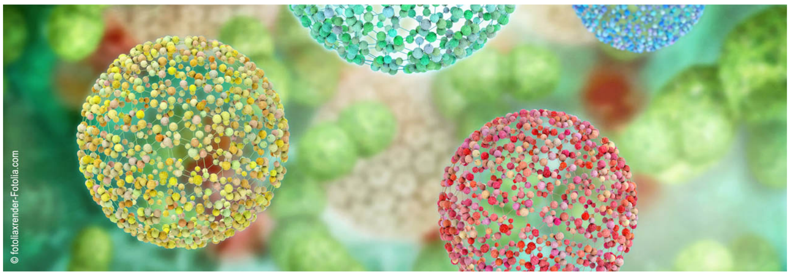

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Quantitative analysis of graphene flakes interactions on liquid copper during CVD growth

Chemical vapour deposition (CVD) of graphene on liquid metal catalysts has recently gained attention due to its uniform, homogeneous surface, which enables an efficient self-defect healing mechanism. This results in the growth of mono-crystalline single-layer graphene (SLG), enhanced mobility, reduced material and energy consumption, and catalyst reusability[1]. Theoretically, it should be possible to obtain a large-scale defect-free SLG through the coalescence of self-assembling graphene flakes. However, experimental observations have shown slight deviations in the self-alignment of the flakes, leading to polycrystalline SLG formation during the later growth stages[2]. This underlying mechanism of self-assembly of the flakes and growth remains inadequately understood. To address this knowledge gap, our study employs radiation mode optical microscopy to quantitatively analyse the flakes' interaction between each other and their environment, with the aim to explain the driving forces behind flake motion. We probe the impact of the flakes' size, the partial pressure of a precursor gas, the size and shape of the liquid copper substrate. The study gives insights into the fundamental forces leading to the motion of graphene flakes on the catalytic surface and the role of reactor design in the motion of flakes in order to obtain the best quality defect-free graphene monolayer, laying the foundation for advancements in large-scale SLG production for further applications in areas such as electronics, quantum technology.

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