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Graphene defect formation during CVD growth

Abstract
Graphene, an atomically thin carbon material, has shown great potential for enabling novel electronic devices that exploit phenomena such as spin transport or hot electron conduction.[1] Many of these applications require extremely high carrier mobilities at wafer-scale.[2] Chemical vapor deposition (CVD) on catalytic substrates has shown the promise for producing high quality graphene and is considered for those applications.[3] Compared to micromechanically exfoliated graphene, however, CVD-grown graphene still exhibits relatively high concentrations of lattice defects that limit its performance.[4]
We here investigate the kinetics of the defect formation process during CVD growth. Control over the graphene growth process was exerted by utilizing confinement effects in narrow pores. A 20fold variation of graphene's growth rate with pore size was observed at constant process parameters (Figure1(a)、(b)). Statistical analysis of Raman spectroscopic results show the impact of graphene growth rate on its defectiveness (Figure2). We observe a surprisingly high rate of defect formation that is counteracted by a defect healing step. Our results suggest that low growth rates are required to form high quality graphene which is confirmed by a fourfold enhancement in graphene's carrier mobility upon optimization of the growth rate.

References

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Figures

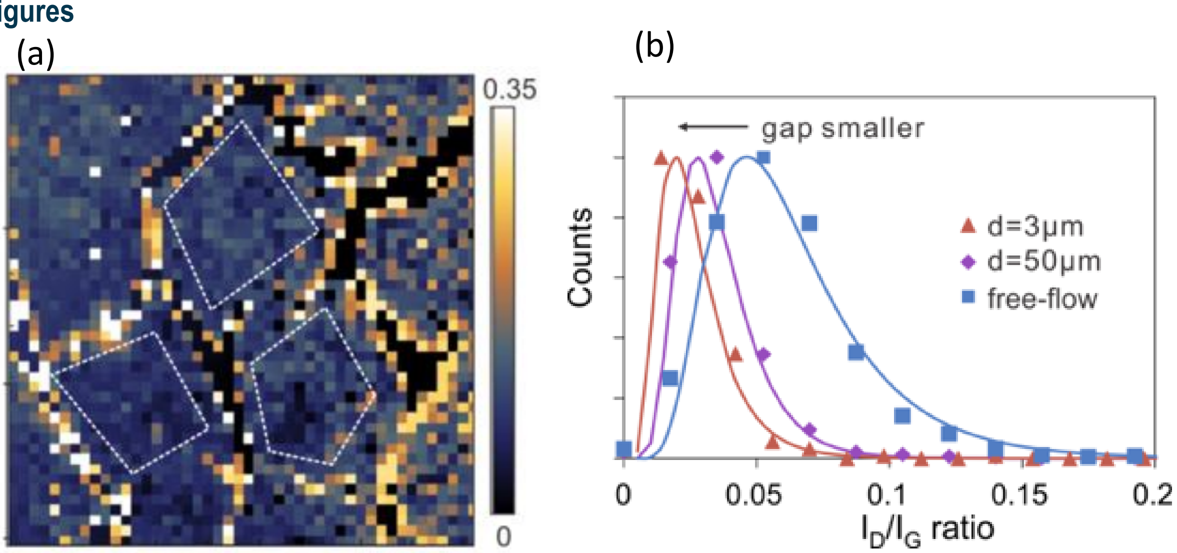

Figure 1: (a) Representative map of the Raman I_D/I_G ratio for graphene grown in a pore with 3μm gap size and 3cm length with indication of areas used for further analysis, **(b)** representative I_D/I_G distributions for three growth rates

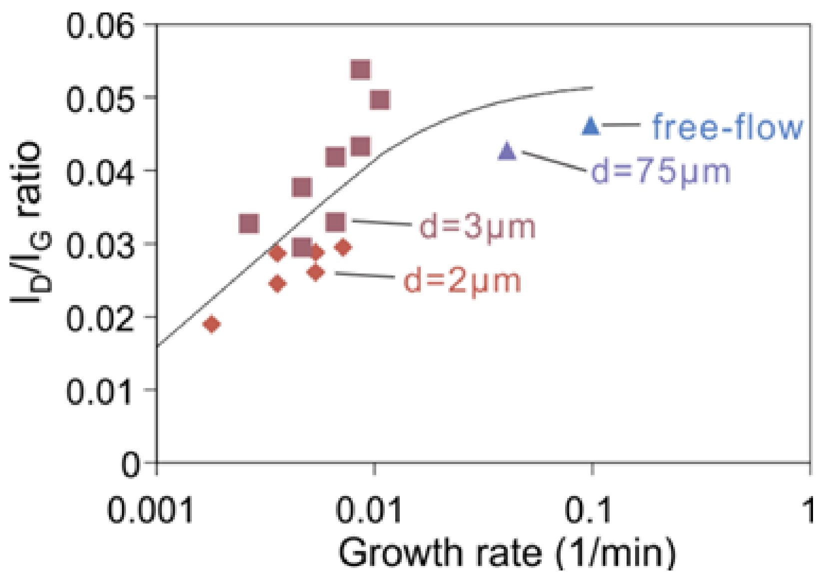

Figure 2: I_D/I_G vs growth rate with fitting experiment data