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Fe-catalyzed etching of graphene layers GUANGJUN CHENG, IRENE CALIZO, ANGELA HIGHT WALKER, NIST, PML, NIST TEAM — We investigate the Fe-catalyzed etching of graphene layers in forming gas. Fe thin films are deposited by sputtering onto mechanically exfoliated graphene, few-layer graphene (FLG), and graphite flakes on a Si/SiO2 substrate. When the sample is rapidly annealed in forming gas, particles are produced due to the dewetting of the Fe thin film and those particles catalyze the etching of graphene layers. Monolayer graphene and FLG regions are severely damaged and that the particles catalytically etch channels in graphite. No etching is observed on graphite for the Fe thin film annealed in nitrogen. The critical role of hydrogen indicates that this graphite etching process is catalyzed by Fe particles through the carbon hydrogenation reaction. By comparing with the etched monolayer and FLG observed for the Fe film annealed in nitrogen, our Raman spectroscopy measurements identify that, in forming gas, the catalytic etching of monolayer and FLG is through carbon hydrogenation. During this process, Fe particles are catalytically active in the dissociation of hydrogen into hydrogen atoms and in the production of hydrogenated amorphous carbon through hydrogen spillover.

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