Beyond Just Graphene: a Viable Synthesis Route to Graphane

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Graphene is a two-dimensional material that exhibits unique electrical, mechanical and optical properties. The derivatives of graphene recently became of large interest because of the possibility of adding new functionalities to graphene and tune its electronic properties. We investigated the growth of carbonaceous hydrogenated graphene films by chemical vapor deposition of ethanol onto copper foils, varying the growth conditions. Our experimental findings are backed by first principles calculations of electronic properties and *ab initio* thermodynamics. The proposed growth mechanism for hydrogenated films onto copper surfaces is based on the partial dehydrogenation (pyrolysis) of the growth precursors adsorbed on copper, which gives rise to the formation of a partially hydrogenated lattice of carbons in a hexagonal pattern, similar to that of graphene. Contrarily to post growth hydrogenated graphene, the material is highly stable with temperature, as predicted for graphane. Our results might open the way to the systematic production of graphane and other 2D graphene derivatives by a single-step chemical vapor deposition process.