

Atomic resolution structural characterization of synthetic graphene

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The commercial implementation of graphene in electronics requires a synthetic method of graphene production. Chemical vapour deposition is a leading approach for growing large area, single crystals of monolayer graphene using a metal as the catalyst. I shall present our recent work on growing graphene on Cu in its molten state and how this results in large uniform single crystals of graphene exceeding 300 microns. These are then transferred to TEM grids in order to study their atomic structure at the single atom level. Using Oxford's JEOL 2200 HRTEM fitted with both probe and image correctors, and a double-wein filter monochromator, we achieve sub-Angstrom resolution at 80 kV than enables the position of C atoms to be fully resolved for the first time. This enhanced resolution from using a monochromator electron source is used to study defects in graphene and to map out C-C bond elongation and compression. We have developed a technique to introduce defects in graphene with spatial accuracy of 10 nm using a focused electron beam in the TEM. Highly strained defect structures are produced that relax back to pristine lattice. This provides important information regarding the actual atomic configuration of defects in graphene and which ones are actually stable enough to persist in graphene and thus have use in further applications.