Graphene growth on Cu mono- and polycrystalline substrates

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CVD is a crucial graphene growth technique, which is performed on the surface of transition metals. In particular, Cu is considered to be an excellent substrate for making high-quality graphene films with uniform thickness due to the low solubility of C in Cu [1]. The bonding of a single graphene layer to a metal surface depends sensitively on the metal surface itself, the quality of copper substrate and the grain size [2].

In this work, we collate data on the properties of graphene films grown on mono- and polycrystalline copper substrates by the CVD method. We compare commercially available graphene films on a Cu foil with graphene grown on different purity copper foils and a Cu(111) monocrystal substrate.

Graphene was deposited on a Cu (111) substrate with pretreatment surface and on a 100μm thick polycrystalline copper foil. The CVD process proceeded in two steps. First, to prepare the substrate surface, copper substrates were annealed either in a H_2/N_2 or H_2/Ar gas mixture at 1020^0C. During the carbonization step, propane gas was used as a carbon precursor. The temperature was maintained at 1020^0C. After deposition, copper substrates covering graphene films were cooled down to a room temperature under an Ar atmosphere.

Graphene grown on both mono- and polycrystalline substrates was investigated using a complementary characterization technique. Raman spectroscopy confirmed the formation of graphitic structures. Moreover, it provided information on the domain size, strain and stacking order of graphene films. The morphology of graphene on metal grains was analyzed by SEM. STM/STS techniques were used to show the topography of the graphene-substrate interface and confirm the uniformity of the graphene layer.

We report that proven quality graphene films on Cu mono- and polycrystalline substrates were obtained. We demonstrate the value of our graphene films by transferring graphene from Cu substrates to target substrates.

References

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