

Large single crystal graphene manufacture

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Large single crystals of graphene were made by using a solvent-catalyst of nickel metal. Both solid and liquid processes were experimented with graphene single crystals of mm demonstrated. The carbon so graphene has phenomenal properties, such as with 100X mechanical strength of steel, 100X of electrical conductivity of copper. However, these superb attributes belong to intact honeycomb lattice (sp²) of carbon atoms. Unfortunately, both natural and man-made graphene products are defects ridden. They are also limited by the honeycomb size (1a) of carbon lattice. Hence, the graphene single crystals available are nanometers across, such bacteria sized graphene is best used as additives, such as strengthening agent for polymers, or for corrosion retardant of coatings. Although CVD methods claim to have large areas of

graphene deposition on metal foils (e.g. Cu), but the bombardment of pyrolytic carbon atoms on substrate is an irreversible (nonequilibrium) process, so most carbon atoms may land in the wrong position and incapable to move to the equilibrium sites. As a result, single crystals with defects density commensurate to silicon wafer in the order of 10 thousands per centimeter are also smaller than one micron; like that those exfoliate from natural graphite. The sublimation of SiC single crystal to form graphene surface suffers the non-equilibrium process in reverse. The reconstitution of remaining carbon atoms, although nearby is kinetically slow at the sublimation temperature. Consequently, the so called graphene wafer is not made, and SiC single crystal wafer itself is expensive and source may be solid or gas. For example, green house effected carbonaceous gas could be used to strip carbon in forming large crystals of graphite that would be a source for making precious graphene.

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