Carbon Nanostructures Through the Use of Three-Dimensional Laser-Lithography Printing

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Three-dimensional carbon nanostructures are a critical component in future electronic and material products across many consumer and industrial applications. Much of the carbon nanostructure is comprised of graphene, a carbon species known for having considerably strong mechanical strength and remarkably high electrical and thermal conductivity. The primarily-graphene, three-dimensional structures are necessary for next-generation processing chips, wearable technology, and liquid filtration; all of which have a need for thermal or electrical conductivities many factors higher than current technology can achieve. Development of multi-layered graphene structures are an important goal of nano-material research in the next decade. Current graphene structures are restricted to vertically or radially aligned carbon nanotubes (CNTs), which are limited to one- or two-layers of graphene atoms. This research approaches the synthesis of these structures by implementing a laser lithography system to create a three-dimensional block. The block undergoes a pyrolization process to burn off non-carbon species, and nickel-chemical vapor deposition (Ni-CVD) to assist the transition to a mostly carbon, sp-2 bond structure. The use of a laser-lithography system allows for the possibility of complex three-dimensional structures that meets the needs of vary industries. This study is conducted in controlled, cleanroom environments, but with a goal of creating a synthesis method that can become relatively low-cost.

Keywords: Nanostructures, Carbon Nanotubes, Graphene