GRAPHENE TECHNOLOGY

Abstract:

Graphene is a relatively new material with unique properties that holds promise for electronic applications. Since 2004, when the first graphene samples were intentionally fabricated, the worldwide research activities on graphene have literally exploded. Dubbed as a "super-material", scientists over the world are scrambling to better understand it. The simplest way to describe graphene is that it is a single, thin layer of graphite — the soft, flaky material used in pencil lead. Graphene's atoms are arranged in a hexagonal arrangement. It is a mere one atom thick, the first two-dimensional material ever discovered. Despite this, graphene is also one of the strongest materials in the known universe. With a tensile strength of 130 GPa (gigapascals), it is more than 100 times stronger than steel. Graphene's incredible strength despite being so thin is already enough to make it amazing, however, its unique properties do not end there. It is also flexible, transparent, highly conductive, and seemingly impermeable to most gases and liquids. This has repeatedly led to very optimistic assessments of the potential of graphene transistors and to an underestimation of their problems. In this paper, we discuss the properties of graphene relevant for electronic applications, examine its advantages and problems, and summarize the state of the art of graphene transistors. Graphene transistors are nanoscale devices with electronic properties far superior to those of silicon. The device is a single-electron transistor, which means that a single electron passes through it at any one time. It is a transparent and flexible conductor that holds promise for various device applications including solar cells, light-emitting diodes (LEDs), touch panels and smart windows. These qualities mean that graphene-based processors could be a fast, low-power successor to silicon-based processors and enable advances in microchip technology beyond the capabilities of those using silicon as their semiconductor material. Graphene of high electronic quality has a bendability of below 5 mm, improved efficiency due to graphene's work function tunability, and the atomically flat surface of graphene helps to avoid electrical shorts and leakage current. Due to light-weight dimensions of graphene based supercapacitors and the minimal cost of production coupled with graphene's elastic properties and inherit mechanical strength, the future awaits brilliance in new technologies.

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