Graphene-Based Infrared Detector

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With technological innovations occurring so rapidly, there has been an increased emphasis on improving infrared detectors, especially for military applications such as night vision, thermal imaging, and missile guidance. A promising manner through which this can be accomplished is by implementing graphene, a single sheet of pure carbon atoms that is the thinnest, lightest, and strongest material ever discovered. The purpose of this research was to determine whether graphene could be effectively implemented into an infrared detector. It was hypothesized that a functional graphene-based infrared device would be created because of graphene's small band gap, broad absorption spectrum, and high charge carrier mobility. The hypothesis was tested by cleaning and dispersing graphene through processes such as sonication and centrifugation. The graphene solution was then passed through a vacuum filtration system that contained a membrane that was impermeable to graphene, thus causing it to stick to the membrane and create a film. Meanwhile, two gold electrodes were placed atop a glass substrate. Finally, the graphene film was lifted onto the gold electrodes to create the final device. The temporal photoresponse was measured by turning an infrared laser on and off for 5 cycles. The results indicated that when the laser was on, the graphene aided in increasing the detector current by as much as 40% compared to when the laser was off. Thus, the hypothesis was supported as a graphene-based infrared device was successfully created. Further research would seek to implement multilayer graphene, dielectrophoresis, nanomanipulation, or ink-jet printing of graphene films.