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LIGHT AND GRAPHENE IN MODERN TECHNOLOGIES

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Abstract

This article is about wonderful key properties of 2D materials, which are used in on optoelectronic applications and other fields. Graphene and other 2D materials are expected to offer an all-in-one solution to the challenges of future optoelectronic technologies because of their tunable optical properties, broadband absorption (from UV to THz), high electrical mobility for ultrafast operation, and novel gate-tunable plasmonic properties.

Keywords: *graphene, 2D materials, sensors, photodetectors*

Introduction

Graphene — and other two-dimensional materials — has a long list of unique properties that have made it a hot topic for intense scientific research and the development of technological applications. This has led to sky-high expectations that applications exploiting 2D materials will become the next disruptive technology impacting several cornerstones of our society [1,2].

Research results

Photodetectors based on 2D materials have a number of distinct, beneficial characteristics. First, graphene is gapless and thus absorbs light in the UV, visible, short-wave infrared, near-IR, photodetector arrays to be monolithically integrated with multi-megapixel read-out electronics for high-resolution imaging or spectroscopy systems [1].mid-IR, far-IR and THz spectral regimes. In addition, 2D material-based photodetectors are extremely fast, with intrinsic limits exceeding 250GHz.

Another important advantage is that 2D materials can be monolithically integrated with silicon electronics, so we can take advantage of the trillions of euros that have been invested in highly advanced Si-CMOS integrated electronics. This will allow graphene

Being one atom thick is in itself a unique characteristic but what makes graphene useful is its ability to bend, stretch, and roll while maintaining its other properties. The emergence of flexible electronics, wearable electronics, and the “Internet of Things” imposes a strong requirement that components, including photodetectors, be foldable and flexible. This is a piece of cake for graphene photodetectors as they can be readily combined with any type of flexible substrate [1].

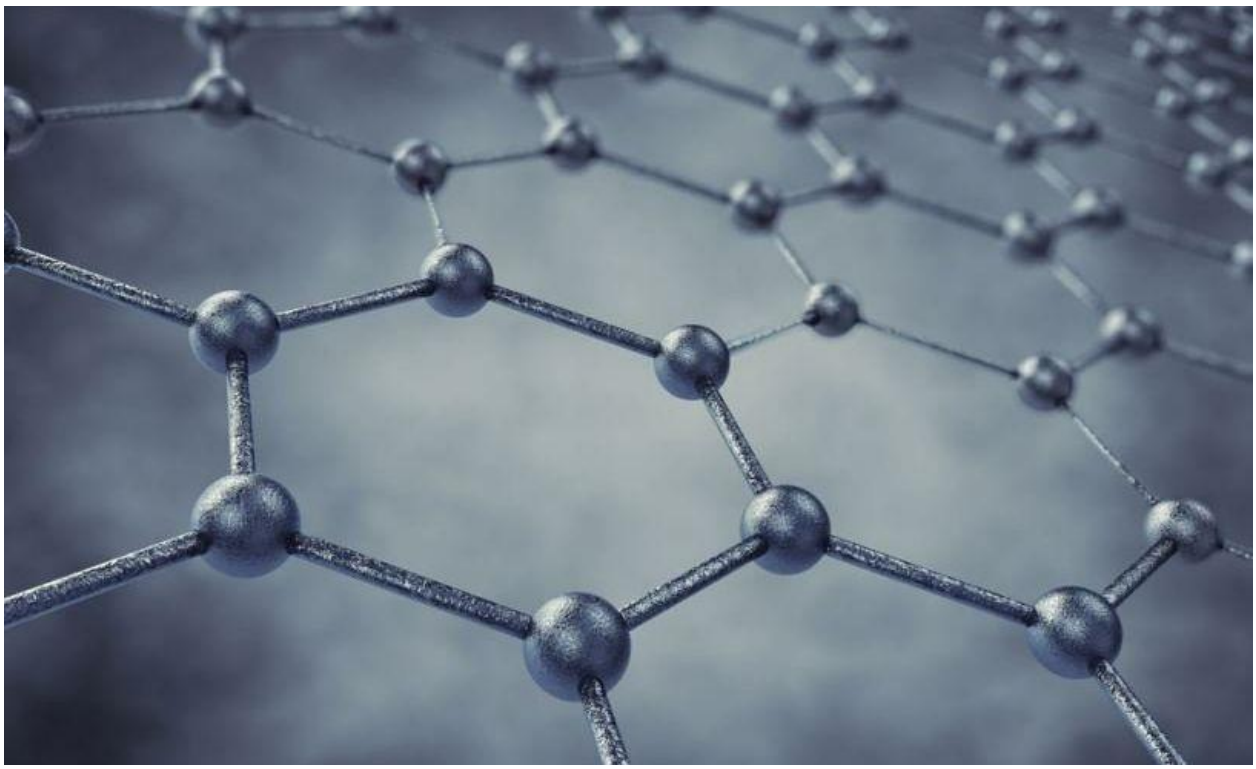

Illustration 1. Structure of graphene

One example of a rather mature and high-performing 2D-material-based photodetector is a hybrid system developed at the Institute of Photonic Sciences (ICFO) that combines 2D materials with semiconductor nanoparticles (quantum dots). This hybrid system, with performance parameters beyond existing technologies, enables very high sensitivities for visible and IR light as well as high photo detection gain of more than a million. [1,2,3]

Additional advantages of this system include low-cost production and the potential to integrate on thin, transparent, and flexible substrates. These hybrid phototransistors are fully compatible with silicon and CMOS technologies, offering large cost reductions in the development and production of the imaging systems as well as the electronics.

This technology will be a competitive alternative for applications in health, safety, security, and automotive systems. For example, flexible, wearable, and compact sensors for health applications can enable constant, noninvasive health monitoring of vital parameters.

By transforming visible and IR sensing and imaging technology into low-cost applications, we can introduce graphene-based applications and devices such as pocket cameras and night-vision goggles into a completely new consumer market. [1,2,3].

Conclusions

It may be concluded that graphene is important Two-Dimensional material in our life. We can create new Ultra-fast battery charging, headphones with phenomenal frequency response,

bionic devices that can connect directly to your body's neurons and a lot of other useful things. Graphene is a platform for high-speed optical modulation and detection on the same chip. By transforming visible and IR sensing and imaging technology into low-cost applications we can introduce graphene-based appliances and devices such as pocket cameras and night-vision goggles into a completely new consumer market.

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