

Broadband graphene based photo detectors for monitoring personal wellbeing

Stijn Goossens¹

Emre O. Polat¹, , Ivan Nikitskiy¹, Gabriel Mercier¹, Eric Puma¹, Shuchi Gupta¹, Carles Monasterio¹, Gabriele Navickaite¹, Teresa Galán¹, Alba Centeno², Amaia Pesquera², Amaia Zurutuza², Turgut Durduran^{1,3}, Gerasimos Konstantatos^{1,3}, Frank Koppens^{1,3}

¹ The institute of photonic sciences, The Barcelona institute of science and technology, Av. Carl Friedrich Gauss 3, Castelldefels (Barcelona), Spain

² Graphenea SA, Tolosa Hiribidea 76, Donostia - San Sebastian, Spain

³ ICREA – Institució Catalana de Recerca i Estudis Avançats, Lluís Companys 23, 08010 Barcelona, Spain.

Contact: stijn.goossens@icfo.eu

Sensors for ubiquitous sensing purposes should be low-cost, invisible and seamlessly integrable with many different surfaces such as bendable plastic, textiles and glass. Graphene based light sensors [1,2] are inherently flexible and transparent and can be integrated with low-cost CMOS technology [3], hence providing a disruptive platform for future wearables and vision devices.

We will show a prototype non-invasive wellness monitor based on graphene-colloidal quantum dot hybrid photo detectors ($D^* > 10^{12}$ Jones for 300-2000 nm, <1ms time response). We leveraged graphene's flexible and transparent properties to create a wearable device that is conformal to the human body so that it can reliably extract vital signs such as heart rate, breathing rate and oxygen saturation (figure 1).

Furthermore, we present a graphene based UV-sensing patch. It records harmful UV-exposure on the skin. The patch does not need a battery as a smartphone provides energy via wireless power transfer (figure 2).

The graphene-based sensing platform enables reliable monitoring of multiple vital signs and ambient conditions (figure 3). This

provides the user a complete picture of his/her current wellbeing, which will be very valuable in preventive healthcare.

References

- [1] G. Konstantatos, et al., Nature Nanotechnol., 7 (June 2012)
- [2] Nikitskiy et al., Nat. Commun., 7 (June 2016)
- [3] Goossens et al., Nat. Phot. 11 (June 2017)

Figures



Figure 1: Graphene based flexible and transparent wellness sensing platform.

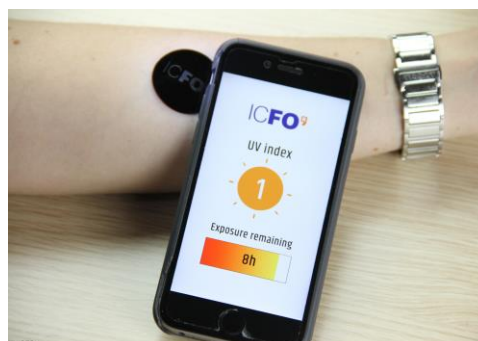


Figure 2: Battery-less UV monitor powered via NFC communication.



Figure 3: Artist impression of graphene and 2D material based patch for monitoring personal wellbeing.