All graphene photodetectors

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The unique properties found in graphene-based material are paving the way to the development of a new generation of multifunctional flexible electronic applications such as flexible communication devices, sensors, photovoltaics, etc.. Understanding the optoelectronic properties of graphene based heterostructures is the first step for exploiting the full potential of this carbon material in flexible and transparent photovoltaic devices. Here we pioneer the field of all graphene photodectors based on heterostructures consisting of the recently discovered FeCl3 intercalated fewlayer graphene (FeCl3-FLG, dubbed graphexeter) and pristine graphene. The FeCl3 intercalation is known to dope graphene to record high charge carrier densities (up to 9*10^14 cm−2) and it drops the room temperature square resistance of graphene to just a few Ohms making this material the best transparent conductor. At the FeCl3-FLG/graphene interface we observe a dominant photovoltage comparable to the signal measured at the graphene/Au interface. We observe a sign reversal of the photovoltage upon sweeping the chemical potential of the pristine FLG through the charge neutrality point and we show that this is due to the photothermoelectric effect. Our results demonstrate that FeCl3-FLG can replace expensive and opaque metals in photovoltaic architectures rendering them mechanically flexible and transparent.

The unprecedented combination of the recently discovered FeCl3-FLG embedded with graphene in heterostructures for photovoltaics constitute a step forward to all-graphene-electronics.