Bromination of graphene: a new route to making high performance transparent conducting electrodes with low optical losses (Presentation Recording)

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ABSTRACT

The high optical transmittance, electrical conductivity, flexibility and chemical stability of graphene have triggered great interest in its application as a transparent conducting electrode material and as a potential replacement for indium doped tin oxide. However, currently available large scale production methods such as chemical vapor deposition produce polycrystalline graphene, and require additional transfer process which further introduces defects and impurities resulting in a significant increase in its sheet resistance. Doping of graphene with foreign atoms has been a popular route for reducing its sheet resistance which typically comes at a significant loss in optical transmission.

Herein, we report the successful bromine doping of graphene resulting in air-stable transparent conducting electrodes with up to 80% reduction of sheet resistance reaching ~180 Ω/□ at the cost of 2-3% loss of optical transmission in case of few layer graphene and 0.8% in case of single layer graphene. The remarkably low tradeoff in optical transparency leads to the highest enhancements in figure of merit reported thus far. Furthermore, our results show a controlled increase in the workfunction up to 0.3 eV with the bromine content. These results should help pave the way for further development of graphene as potentially a highly transparent substitute to other transparent conducting electrodes in optoelectronic devices.

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