

# Gate-tunable Modulation of the Optical Properties of Multilayer Graphene by the Reversible Intercalation of Ionic Liquid Anions

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**Date: Friday, March 24, 2023 14:30-16:00**

**Venue: Faculty of Engineering Bldg. 2, Room 31A**

### Abstract:

We demonstrate a substantial modulation of the optical properties of multilayer graphene (~100 layers) using a simple device consisting of a multilayer graphene/polymer electrolyte membrane/gold film (MLG/PEM/Au) stack. Applying a voltage of 3-4V drives the intercalation of anion [TFSI]<sup>-</sup> (ion liquid diethylmethyl(2-methoxyethyl)ammonium bis(trifluoromethylsulfonyl)imide [DEME][TFSI]) resulting in the reversible modulation of the properties of this optically dense material. Upon intercalation, we observe an abrupt shift of 35 cm<sup>-1</sup> in the *G* band Raman mode, an abrupt increase in the FTIR reflectance over the wavelength range from 1.67 to 5 μm (2000 – 6000 cm<sup>-1</sup>), and an abrupt increase in the luminescent background observed in the Raman spectra of the graphene. All of these abrupt changes in the optical properties of this material arise from the intercalation of the TFSI<sup>-</sup> ion and the associated change in the free carrier density ( $\Delta n = 10^{21}$  cm<sup>-3</sup>). Suppression of the *D* band Raman mode observed around 3V corresponds to Pauli blocking of the double resonance Raman process and indicates a modulation of the Fermi energy of  $\Delta E_F = 1.1$ eV.



**Registration:**  
<https://forms.gle/RtBcEPxg6CqHMNGW9>  
**Please register by Mar.22.**

主催:

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 統合物質・科学国際卓越大学院 (MERIT-WINGS)  
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