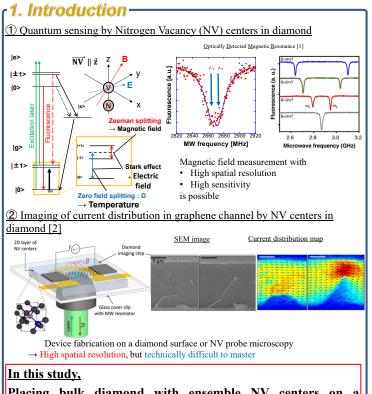
Visualization of current-induced magnetic field distribution in graphene FETs using NV centers in diamond

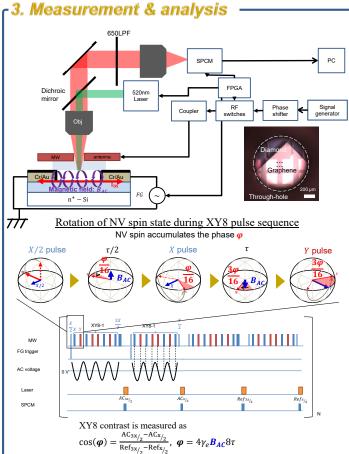
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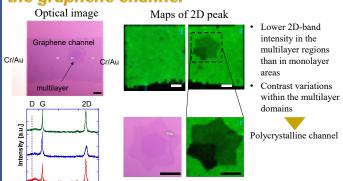


Placing bulk diamond with ensemble NV centers on a graphene channel, we map the current distribution by measuring stray AC magnetic field.

r 2. Fabrication 1. Spin coating 2. Photolithography 3. Electrode deposition **Photoresist** 4. Graphene transfer 5. Forming of channel 6. Optical image

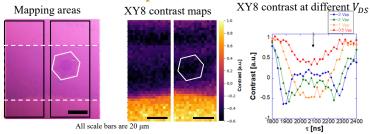


4. Raman spectra and 2D maps of the graphene channel



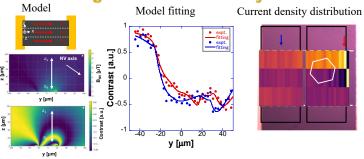
All scale bars are 10 µm

5. XY8 contrast map



- Dips around 2060 ns in response to the AC magnetic field sensed by the NV spin.
- The XY contrast maps reflect the structural features of the channel (the narrowing lower edge)
- A region of reduced contrast shifted toward the upper right from the multilayer domain, indicating a modulation of current distribution.

16. Model fitting and current density distribution



- Three parallel current paths with different current densities j_{xi}
- The contrast over the depth range z_0 to z_1 was numerically averaged to account for depth averaging
- $\rightarrow j_{xi}$, z_0 , and z_1 were fitted
- The current distribution mapping revealed distinct modulations in current density within the graphene channel
- Grain boundaries and multilayer domain can be contributors [3,4]

7. Summarv

Current distribution mapping using ensemble NV centers in bulk diamond can reveal subtle structural inhomogeneities in graphene channels that are not readily observable via conventional optical and/or Raman techniques.

8. Reference

- G Balasubramanian et al., Curr Opin Chem Biol 20, 69-77 (2014).
 J.P. Tetienne et al. Sci. Adv. 3, e1602429 (2017).
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