

Supporting Information for

Laser-induced Graphene Based Digital Microfluidics (gDMF): A

Versatile Platform with Sub-one-dollar cost

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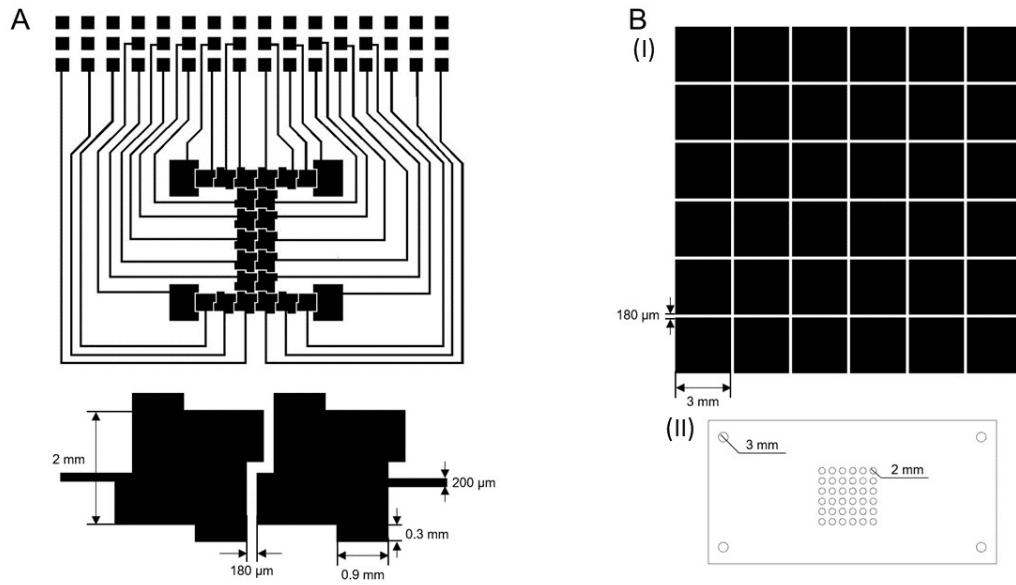


Fig S1. Laser scribing patterns of gDMF chips. (A) Electrode pattern of planar addressing gDMF chips (pgDMF). (B) A 6×6 electrodes pattern (I) and supporting layer with connection holes (II) of vertical addressing gDMF chips (vgDMF).

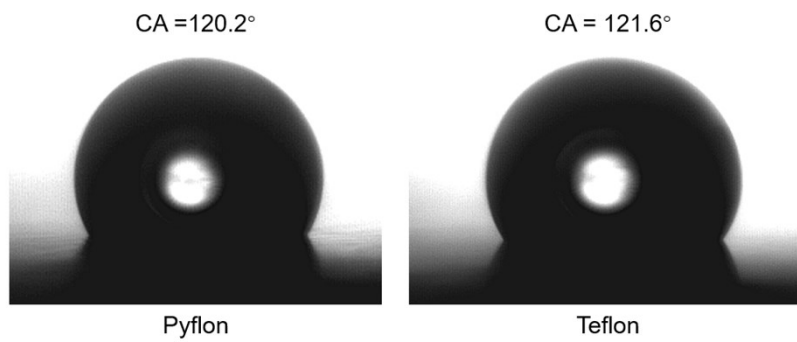


Fig S2. Contact angle (CA) of Pyflon and Teflon films.

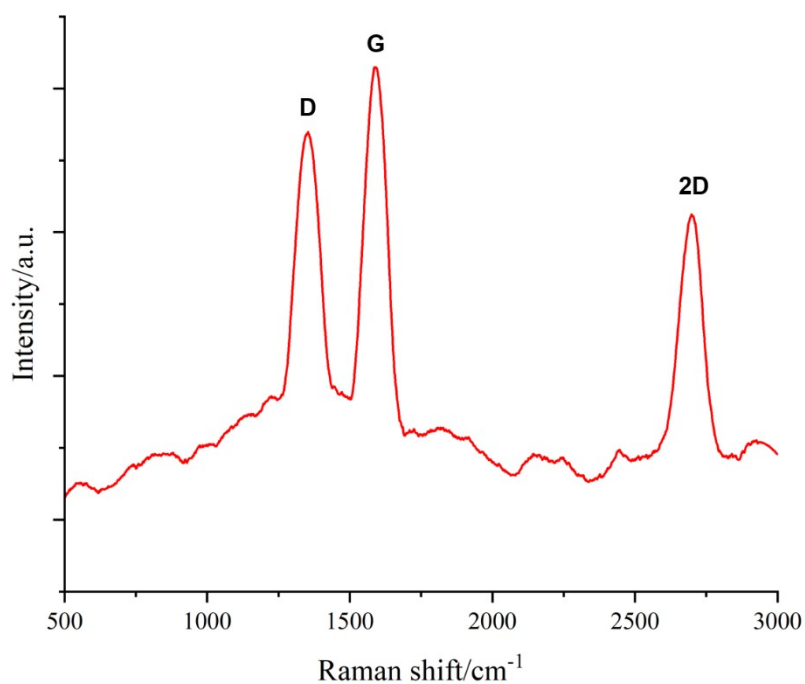


Fig S3. Raman spectrum of the LIG electrodes. Three main peaks can be observed at $\sim 1350\text{ cm}^{-1}$ (D peak), $\sim 1580\text{ cm}^{-1}$ (G peak) and $\sim 2700\text{ cm}^{-1}$ (2D peak), which are consistent with previous reports,¹⁻³ proving the successful generation of porous graphene.

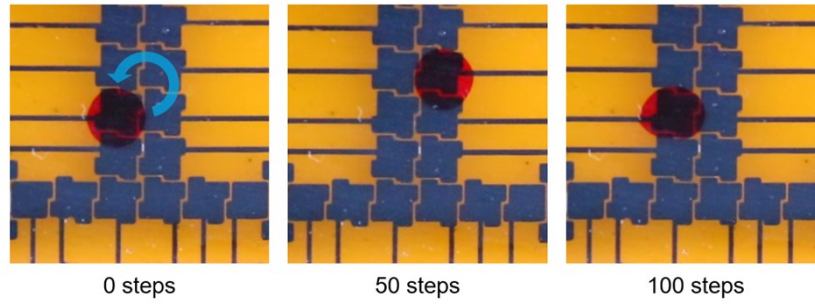


Fig S4. Continuous droplet (1 mg/mL PBS buffer) movement on pgDMF. No droplet residue was observed after 100 steps movement.

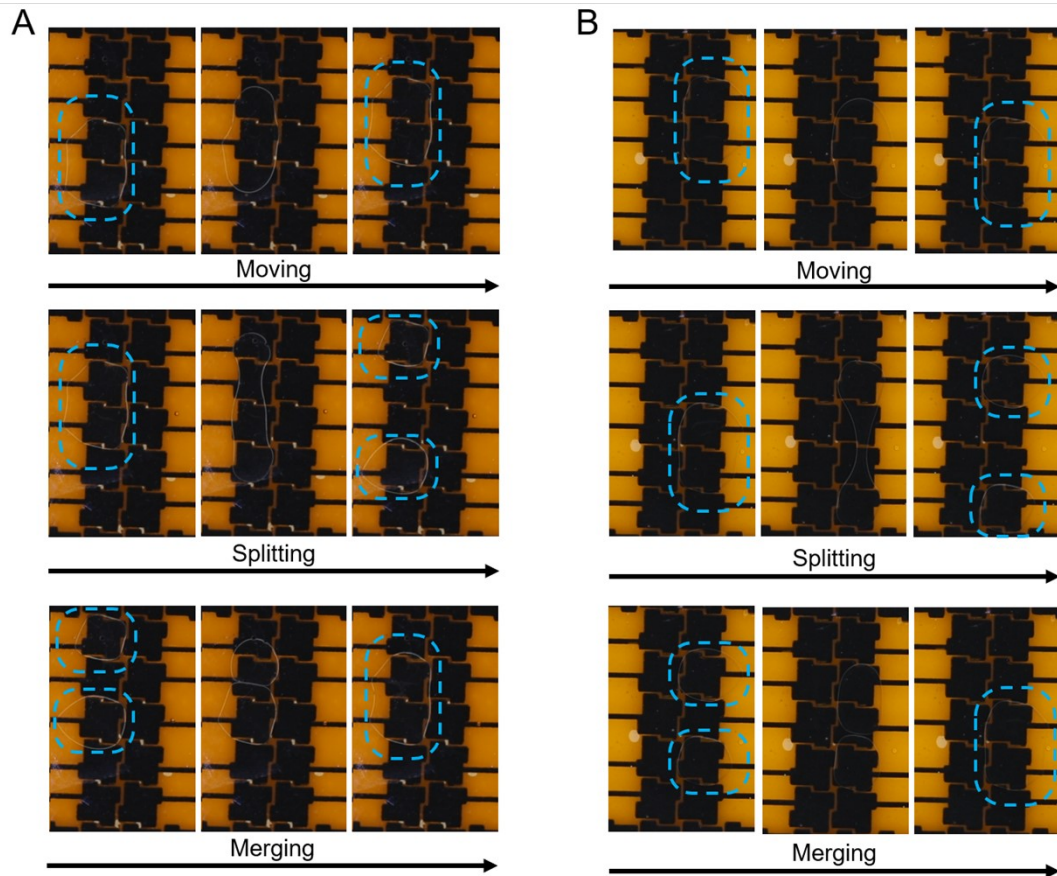


Fig S5. Manipulation of (A) a PCR amplification mix buffer (Master Mix, Vazyme Biotech) and (B) 1 M MgCl₂ solution droplets on pgDMF.

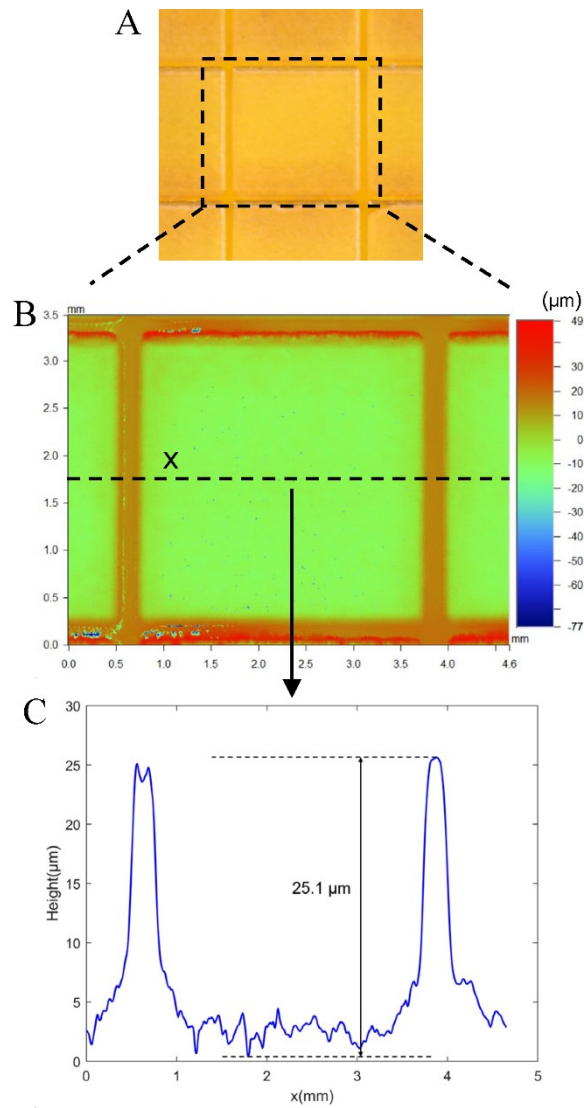


Fig S6. Surface height characterization of LIG-removed PI film. (A) Photo of the PI film surface after removing the LIG electrodes by ultrasonic cleaning. (B) White light interferometry (WLI) image of the PI film with LIG removed. (C) Height along the line shown in Fig. S3B. The maximum depth obtained from the measurements is approximately 25.1 μm .

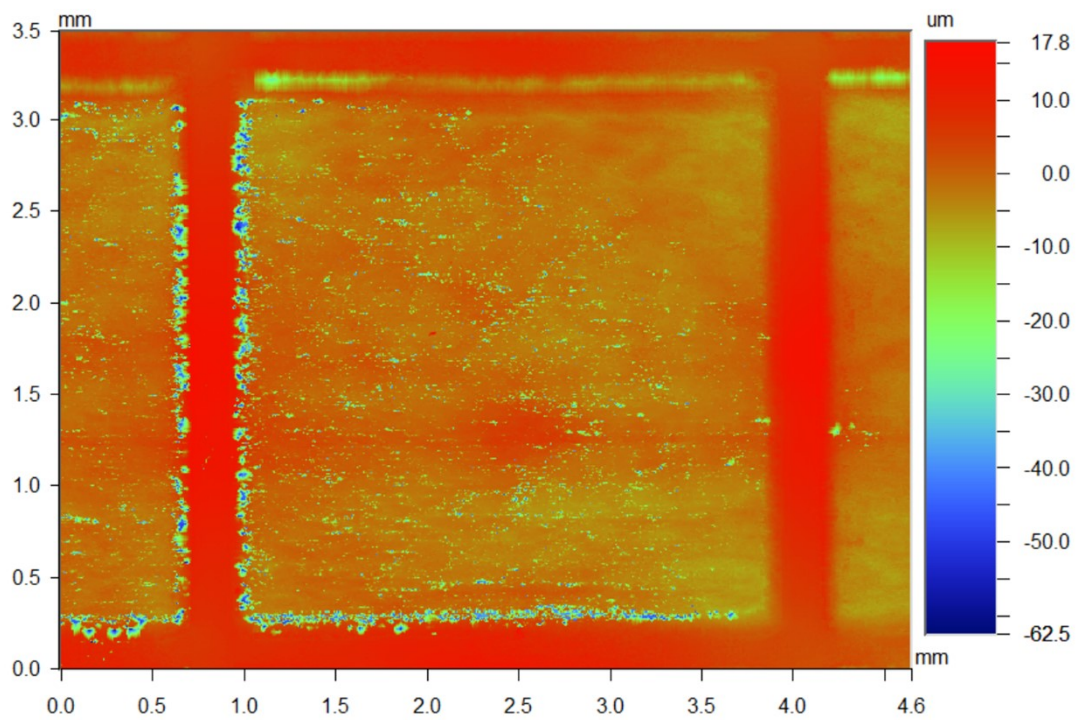


Fig S7. Height profile of PI film surface (opposite to LIG electrodes) of vgDMF chip.

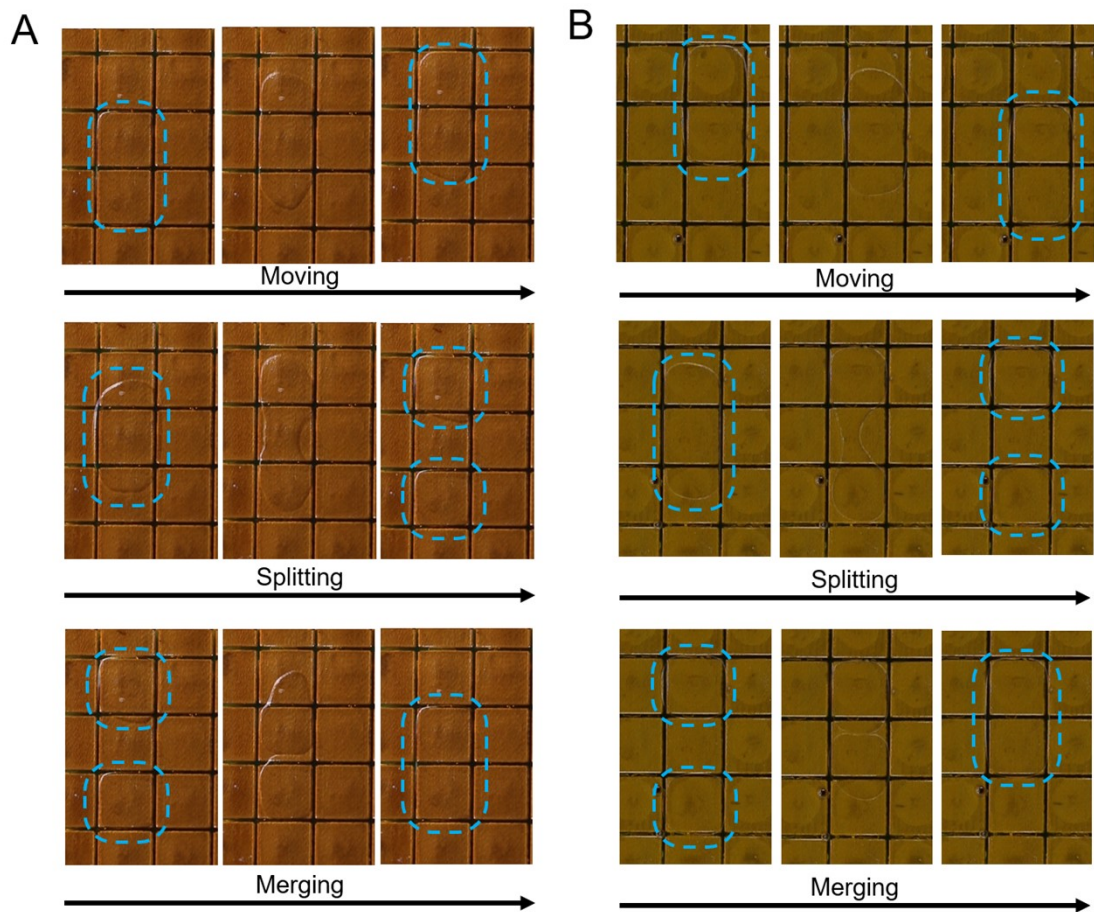


Fig S8. Manipulation of (A) a PCR amplification mix buffer (Master Mix, Vazyme Biotech) and (B) 1 M MgCl₂ solution droplets on vgDMF.

Table S1. Detailed cost of pgDMF devices.

<i>Materials</i>	<i>Price</i>	<i>Quantities</i>	<i>Cost</i>
Polyimide film	\$6.3 /m ²	40 cm ²	\$0.03
PMMA sheet	\$12.6 /m ²	60 cm ²	\$0.08
ITO film	\$28.0 /m ²	20 cm ²	\$0.06
PETMP	\$0.16 /mL	1 mL	\$0.16
TATATO	\$0.04 /mL	0.5 mL	\$0.02
HMPP	\$0.04 /mL	0.02 mL	\$0.01
FAA	\$3.24 /mL	0.15 mL	\$0.49
<i>Total</i>			\$0.85

Table S2. Detailed cost of VgDMF devices.

<i>Materials</i>	<i>Price</i>	<i>Quantities</i>	<i>Cost</i>
Polyimide film	\$6.3 /m ²	40 cm ²	\$0.03
PMMA sheet	\$12.6 /m ²	60 cm ²	\$0.08
ITO film	\$28.0 /m ²	20 cm ²	\$0.06
Double-sided tape	\$16.1 /m ²	40 cm ²	\$0.07
Pyflon	\$0.7 /g	0.5 g	\$0.35
<i>Total</i>			\$0.59

Movies:

Movie S1: The laser scribing process to fabricate LIG electrodes.

Movie S2: Droplet manipulations on pgDMF chip (3X speed).

Movie S3: Droplet manipulations on vgDMF chip (2X speed).

References

- 1 J. Lin, Z. Peng, Y. Liu, F. Ruiz-Zepeda, R. Ye, E. L. G. Samuel, M. J. Yacaman, B. I. Yakobson and J. M. Tour, *Nat. Commun.*, 2014, 5, 5714.
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- 3 R. Ye, D. K. James and J. M. Tour, *Acc. Chem. Res.*, 2018, 51, 1609-1620.