Electronic Supplementary Information

Holey graphene film as a high performance planar field emitter

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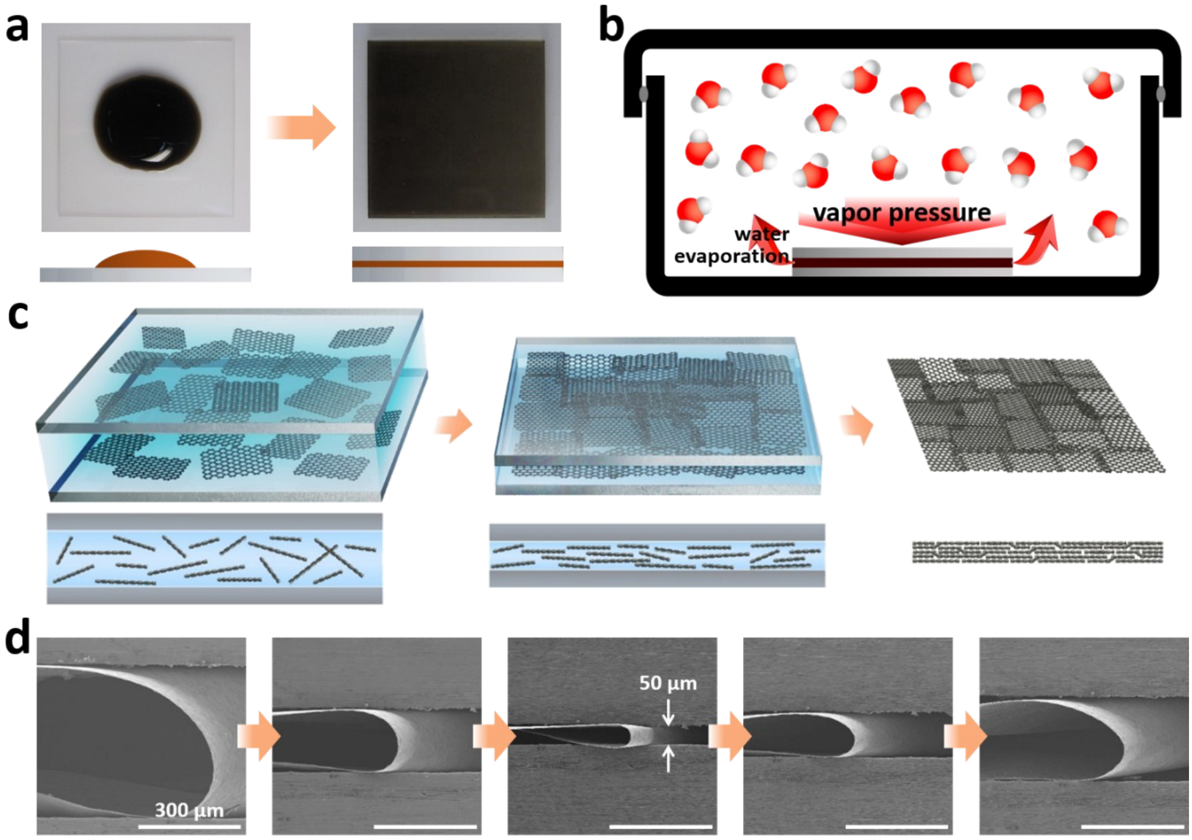

Fig. S1 (a) Top (optical images) and side (schematics) views, illustrating sample preparation. The second frame shows that graphene oxide (GO) solution is confined between two glass plates by capillary effect. (b) Schematic illustration of CVHT process. (c) Schematic illustration of the formation of graphene film during CVHT process. As the water vapor escapes along the plane direction of the glass plates and the pressure is exerted on them, GO nanosheets (rectangles in the upper row and the lines in the bottom row) tend to laminate directionally. (d) Bending gap of GF can be rendered as small as 50 μm without causing buckling. The film returns to its original shape upon releasing the compression.

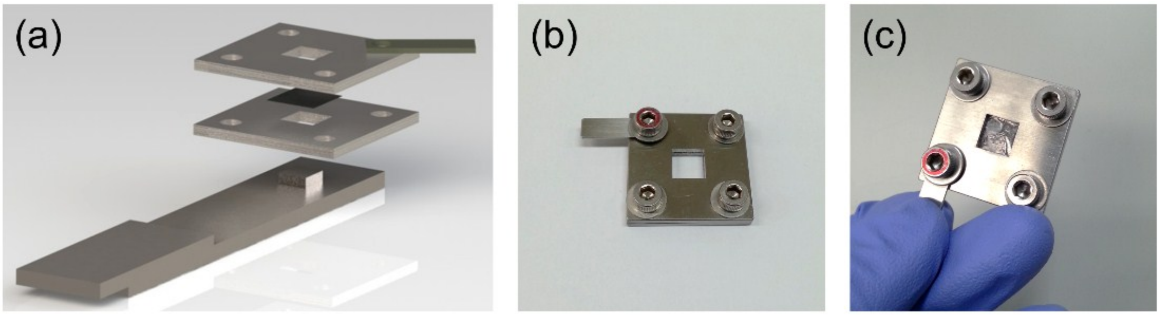

Fig. S2 (a) Schematic illustration of field emission setup using HGF. (b) Optical image of the jig for holding the HGF. (c) Optical image of the jig after loading the graphene film.

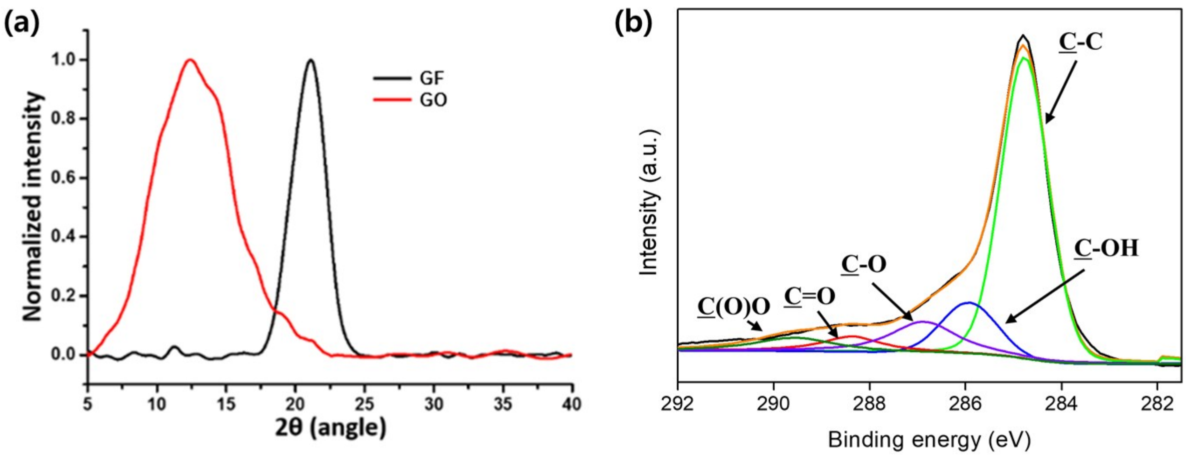

Fig. S3 (a) XRD spectra of GF and GO paper. The GF peak is much sharper, indicating a better ordering of nanosheets. (b) XPS spectra of GF.

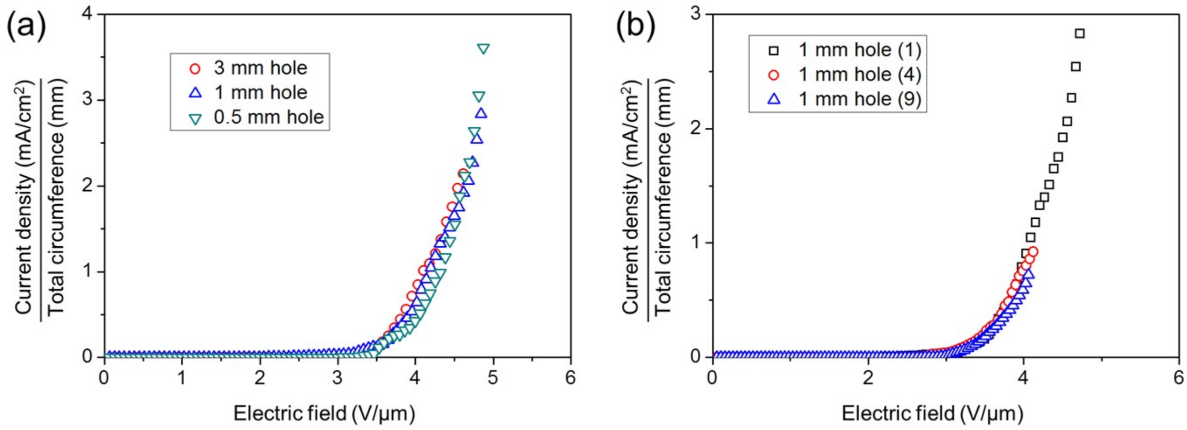

Fig. S4 (a, b) The ratio of the current density to total circumference of holes as a function of electric field. (a) HGF with hole diameter ranging from 500 to 3000 μm. (b) HGF for various number of circular holes.

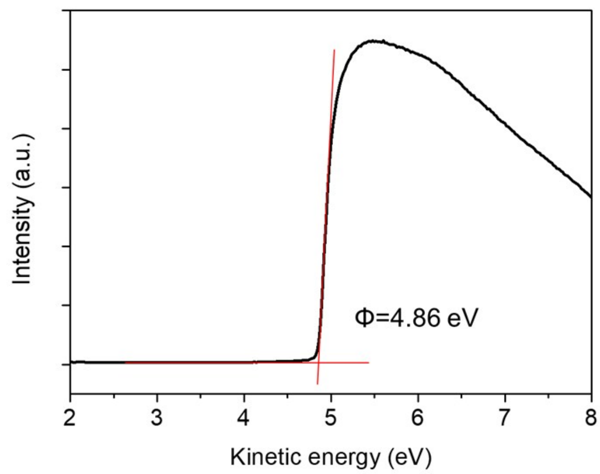

Fig. S5 The UPS spectrum of GF around the secondary-electron cutoff region.

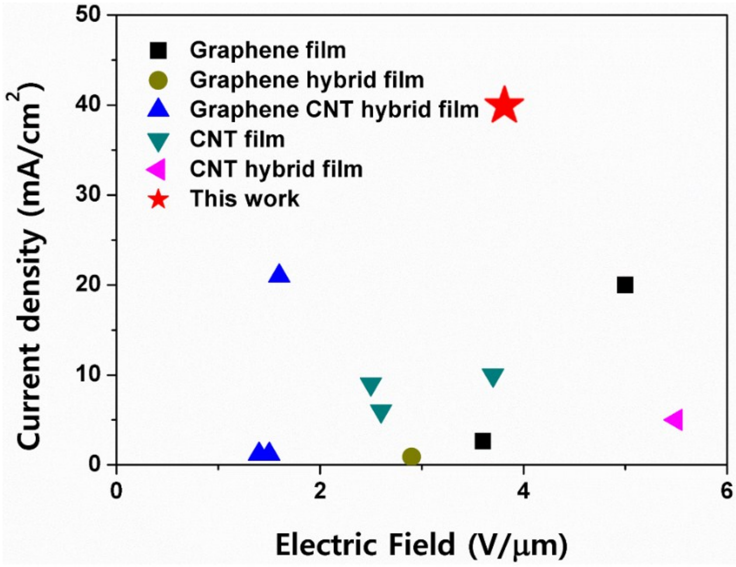

Fig. S6 Performance comparison of this work with other planar emitters fabricated by various structures such as graphene film,[1,2] graphene hybrid film,[3] graphene CNT hybrid film,[4-6] CNT film,[7-9] CNT hybrid film.[10] The HGF planar emitter shows an outstanding performance with a high current density of 40 mA/cm^2 at 3.8 V/μm compared with the previously reported emitters.

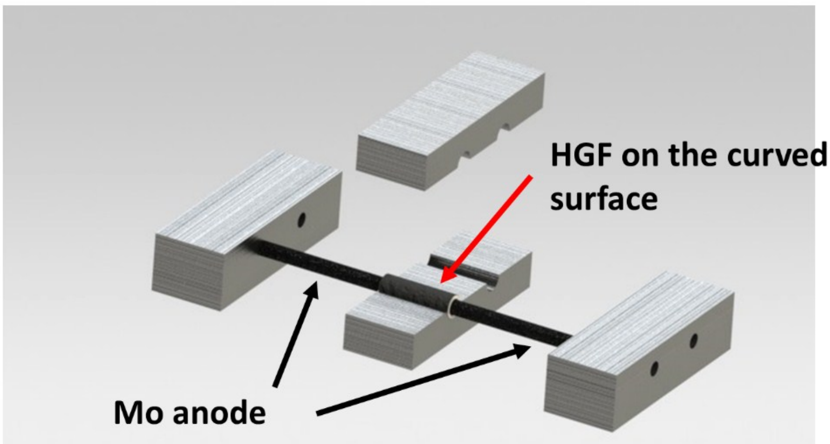

Fig. S7 Schematic illustration of flexible field emission setup using HGF for focused electron beam.

References

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