Supporting Information

Room-Temperature, Highly Durable $Ti_3C_2T_x$ MXene/Graphene Hybrid Fibers for NH₃ Gas Sensing

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Figure S1. (a) Optical, (b) SEM images of MAX phase powders, (c) photograph of MAX phase showing the poor dispersion in water, (d) photographs of pH-dependent dispersions for MXene/GO solution. (e) photograph of MXene aqueous dispersion, and (f) photograph of dispersion of MXene/GO in DMF.



Figure S2. (a) SEM, (b) AFM, and (c) C-AFM images of MXene GO dispersion were taken in the same area, (b) AFM image shows that the lighter and darker sheets are 1.3 nm and 1.7 nm thick, respectively. (c) In the C-AFM image, MXene sheets were distinguished by electrical conductivity.



Figure S3. Photograph of MXene/rGO fiber (40 wt% MXene) wound on a glass Pasteur pipet.



Figure S4. Ti 2p in XPS corrected the peak area ratio of MXene, MXene/rGO (MXene 40 wt%).



Figure S5. Morphology of rGO fiber and MXene/rGO hybrid fiber (40 wt% MXene). (a, b) EDS elemental mapping of (a) MXene/rGO hybrid fibers, and (b) rGO fibers, scale bar is 25 µm, (c-j) SEM images of the morphology of MXene/rGO fiber and rGO fiber, (c) tilted, (d) cross-section, and (e-f) longitudinal-section of MXene/rGO hybrid fiber, and (g) tilted, (h) cross-section, and (i-j) longitudinal-section of rGO fiber.



Figure S6. Cross-section SEM observation and corresponding EDS elemental mapping of rGO fiber and MXene/rGO hybrid fiber (40 wt% MXene). (a) Cross-section and (b) close-up view of the MXene/rGO hybrid fiber. (c) Cross-section and (d) close-up view of the rGO fiber.



Figure S7. (a) Kubelka-Munk function versus energy (eV) curve of MXene, rGO, and MXene/rGO (The MXene content was set to 40 wt%). (b) UPS analysis of MXene, rGO, and MXene/rGO (40 wt% MXene). (c) Dependence of gas response on the band gap variation for different MXene contents. (d) Comparison of gas response based on structure type.



Figure S8. (a) Electrical resistivity and conductivity of MXene/rGO fiber with MXene contents vary from 0 to 80 wt%. (b) MXene/rGO fibers with different MXene content are changed electrical resistance due to reduced bending radius.