CLAIMS

1. A membrane for dehydration of a gas, comprising:

a support;

a composite comprising a graphene oxide compound and a sulfonated polymer, wherein the sulfonated polymer comprises sulfonated polyvinyl alcohol, sulfonated polyacrylic acid, sulfonated polyether ether ketone, sulfonated polystyrene, or a combination thereof, wherein a weight ratio of the graphene oxide compound relative to the sulfonated polymer is 0.1:100 to 1:10;

wherein the composite is coated on the support; and

wherein the membrane is a gas dehydration membrane, the membrane having a moisture permeability of at least 3.2×10^{-5} g/m^2·s·Pa as determined by ASTM E96, and a gas permeability of at most 7.2×10^{-6} g/m^2·s·Pa as determined by ASTM 6701.

2. The membrane of claim 1, wherein the support is porous.

3. The membrane of claim 1 or 2, wherein the support comprises polypropylene, polyethylene terephthalate, polysulfone, polyether sulfone, or a combination thereof.

4. The membrane of claim 1, 2, or 3, wherein the graphene oxide compound and the sulfonated polymer are cross-linked.

5. The membrane of claim 1, 2, 3, or 4, wherein the graphene oxide compound comprises graphene oxide, reduced graphene oxide, functionalized graphene oxide, reduced functionalized graphene oxide, or a combination thereof.

6. The membrane of claim 1, 2, 3, 4, or 5, wherein the graphene oxide compound has a platelet size of 0.05 µm to 100 µm.

7. The membrane of claim 1, 2, 3, 4, 5, or 6, wherein the composite further comprises an alkali metal halide or an alkaline earth metal halide.

8. The membrane of claim 7, wherein the alkali metal halide is lithium chloride and the alkaline earth metal halide is calcium chloride.

9. The membrane of claim 7 or 8, wherein the alkali metal halide is lithium chloride and the composite further comprises sodium lignosulfate.

10. The membrane of claim 7 or 8, wherein the alkali metal halide is lithium chloride and the composite further comprises sodium lauryl sulfate.

11. The membrane of claim 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10, further comprising polyvinyl alcohol.

12. The membrane of claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or 11, further comprising polyacrylic acid.

13. The membrane of claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12, further comprising sodium lauryl sulfate.

14. The membrane of claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13, wherein the composite is coated on the support as a film having a thickness between 2 μm to 400 μm.

15. A method of dehydrating a first gas, comprising applying the membrane of claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, or 14, to the first gas.

16. The method of claim 15, further comprising applying a water vapor pressure gradient across the membrane to cause water vapor to selectively pass through the membrane, wherein the first gas applies a higher water vapor pressure to a first side of the membrane than a water vapor pressure applied by a second gas to a second side of the membrane, so that water vapor passes through the membrane from the first gas to the second gas.

17. The method of claim 15 or 16, wherein the first gas applies a higher total pressure to the first side of the membrane than a total pressure applied by the second gas to the second side of the membrane.

18. The method of claim 15, 16, or 17, wherein the first gas is air, oxygen, or nitrogen.