Graphene as a new material for fuel cells

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Currently polymer electrolyte membrane fuel cells (PEFC) are limited to operation at relatively low temperature, due to necessary hydration of the Nafion membrane. Higher PEFC operation temperature increases reaction kinetics, meaning that platinum catalyst loading can be reduced. Clearly new membranes are needed for the next generation of fuel cells.

Graphene, a monolayer of carbon atoms, has remarkable properties, e.g. high theoretical specific surface area (2630 m^2g^{-1}) and high Young's modulus (1.0 TPa).[1] As such it is an interesting material to use in PEFC membranes, for example to improve the temperature stability whilst retaining high proton conductivity.

Most work so far has concentrated on composite materials. Incorporating a few weight % of graphene or graphene oxide in e.g. Nafion or SPI yielded significant improvements in the proton conductivity and the mechanical properties.[2,3]

Our approach is the use of pure graphene oxide membranes. We have prepared free-standing graphene oxide membranes via filtration from solution, ranging from several microns to ~100 microns. Results of the membrane characterization will be presented.

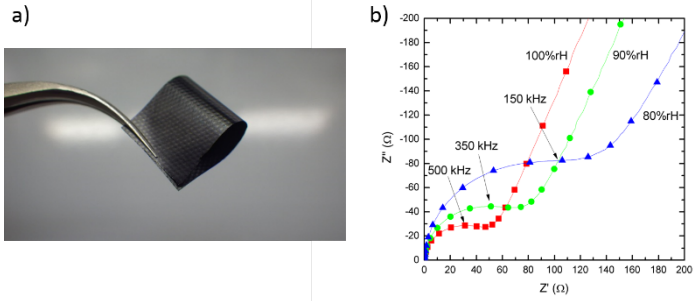

Figure 1 (a) Graphene oxide membrane (15µm thick); (b) Impedance spectra of graphene oxide

References

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