

# Swelling of graphene oxide membranes in alcohols: effects of molecule size and ageing.

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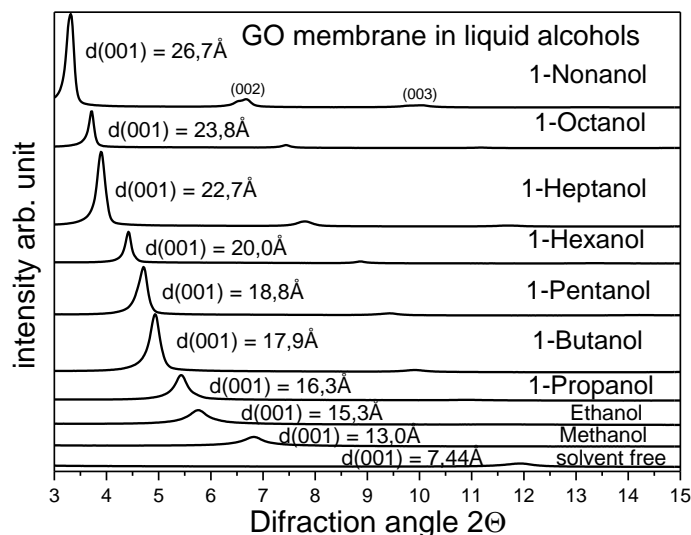
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Swelling of Hummers graphite oxides and graphene oxide (HGO) membranes in a set of progressively longer liquid alcohols (methanol to 1-nonanol) was studied using synchrotron radiation XRD. Both precursor graphite oxides and freshly prepared HGO membranes were found to swell in the whole set of liquid alcohols with increase of interlayer spacing from  $\sim 7\text{\AA}$  (solvent free) up to  $\sim 26\text{\AA}$  (in 1-nonanol). Pronounced ageing effects were observed for membranes stored on air for periods over 3-6 months with significant sample to sample variations. The HGO membranes and thin films stored at ambient conditions for 5 years showed nearly complete absence of swelling in all alcohols but preserved swelling in water. In contrast, graphite oxide powders showed unmodified swelling in alcohols even after 4 years of air storage. The ageing of GO membranes can be considered as a method to tune swelling properties of HGO membranes for better selective permeability. Ageing of GO membranes during on air storage can be one of reasons for strong scatter of permeation properties reported over past years.<sup>1</sup> Standardization of drying and storage conditions is required for better reproducibility of experiments with GO membranes.

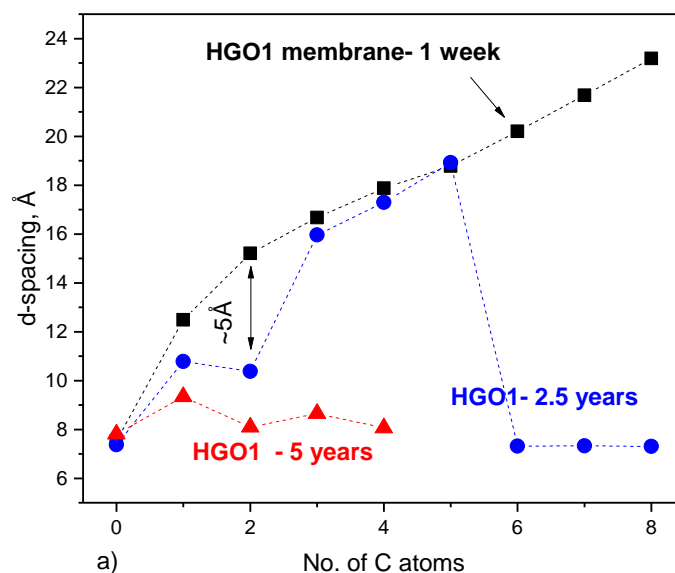
## References

- [1] (Amadei, C. A.; Vecitis, C. D., J Phys Chem Lett 2016, 7 (19), 3791-3797.

## Figures



**Figure 1:** XRD patterns recorded from of GO powder immersed in excess of liquid alcohols of different length (CuK $\alpha$  radiation)



**Figure 2:** GO membranes swelling in alcohols: Interlayer distance provided by  $d(001)$  for freshly prepared sample and samples store don air for prolonged period of time