Swellable assemblies of graphene oxide nanosheets

Tamás Szabó[1*], Alexandr Talyzin[2]

[1]Department of Physical Chemistry and Materials Science, University of Szeged, Hungary
[2]Department of Physics, Umeå University, Sweden
[*]E-mail: sztamas@chem.u-szeged.hu

The tunable solvation/layer expansion properties of graphene-based particle assemblies are relevant for various applications including humidity sensing or membrane separation of solutes by size exclusion mechanisms. This contribution presents our structural studies on nanosheet networks (multilayered particles, membranes, ultrathin films) of graphene oxide (GO) exhibiting swelling by the intercalation of liquid water, alcohols and humid vapors. Intercalation of GO powders using liquid solvents is rapid and typically saturates within minutes, in contrast to intercalation by vapors which, depending on the vapor pressure, may take hours to achieve equilibrium state. We found that GO membranes exhibited unique solvation properties, not found in precursor graphite oxide powders [1]. In particular, both GO membranes and graphite oxides are hydrated very similarly in pure water, but insertion of ethanol and methanol into the GO membrane structure is hindered. It is limited to one monolayer while in graphite oxide (multilayered particles) up to 3–4 layers of these solvents are inserted. Some remarkable temperature and pressure dependent swelling features of GO assemblies will also be discussed.

Acknowledgments
This work was financially supported by the grant NKFI KH-126498.

Reference
[1] AV Talyzin, T Hausmaninger, S You, T Szabó, The structure of graphene oxide membranes in liquid water, ethanol and water–ethanol mixtures. Nanoscale 6:272 (2014)