

Generating, Storing and Transporting Hyperpolarization with HYPOP (Hyperpolarizing Porous Polymers)

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More than fifteen years after its invention, dissolution dynamic nuclear polarization (d-DNP)[1] had apparently settled into well-defined technologies and methodologies, and it was mostly believed that d-DNP needed to be performed at the point of use. However recently, a series of advances have shaken foundations of d-DNP. For the first time, it was demonstrated that d-DNP could potentially be performed remotely, off-site,[2] thus without the need of a polarizer on-site.

In our group, we have in the past years, merely been working at improving efficiency,[3] compatibility,[4] and repeatability[5] of d-DNP. Our candid objective basically was to enable (or at least to improve) applications; nonetheless it has led us to develop a new concept i) to dramatically extend hyperpolarization lifetimes from minutes to days and, ii) to enable transport to far distant MRI or NMR sites.[2]

We are now generalizing this new concept to a broad range of systems, such as neat endogenous tracers, mixtures of metabolites, or amino acids, by developing new hyperpolarizing solids such as our silica-based HYPSON materials, or more recently hyperpolarizing porous polymers (HYPOP). These can be impregnated with arbitrary solutions that are then hyperpolarized efficiently and stored and transported over hours, before being melted and released. We will in particular present a new epoxy-based polarizing material. We'll show how the porosity and morphology of this material can be tuned, and we will present DNP results on the very first generation of these new materials.[6]

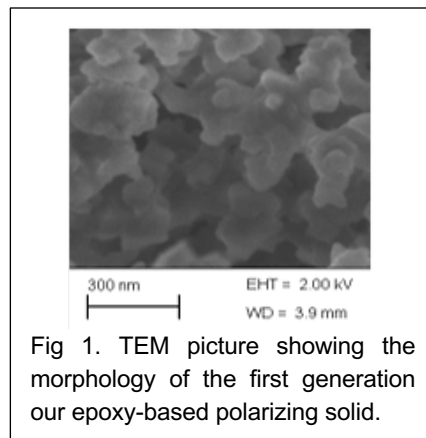


Fig 1. TEM picture showing the morphology of the first generation our epoxy-based polarizing solid.

[1] Ardenkjaer-Larsen, J. H. *et al. Proc. Natl. Acad. Sci.* **100**, 10158–10163 (2003).

[2] Ji, X. *et al. Nat. Commun.* **8**, (2017). Capozzi, A. *et al. Nat. Commun.* **8**, 15757 (2017).

[3] Bornet, A. *et al. J. Phys. Chem. Lett.* **4**, 111–114 (2013). Bornet, A. *et al. Chem. Phys. Lett.* **602**, 63–67 (2014). Bornet, A. *et al. Phys. Chem. Chem. Phys.* **18**, 30530–30535 (2016).

[4] Gajan, D. *et al. Proc. Natl. Acad. Sci. USA* **111**, 14693–14697 (2014). Cavaillès, M. *et al. Angew. Chemie Int. Ed.* (2018). doi:10.1002/anie.201801009. Vuichoud, B. *et al. J. Phys. Chem. B* **118**, 1411–1415 (2014)

[5] Bornet, A. *et al. Anal. Chem.* **88**, 6179-6183 (2016)

[6] El Daraï, T. *et al.* In preparation.