A powder to enhance NMR signals

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Nuclear Magnetic Resonance (NMR) Spectroscopy is an extremely powerful non-destructive technique for the characterization of molecules. Widely used by chemists from its origin, it is now essential in the synthesis and analysis laboratories and sees its scope extended in biological laboratories.

Coupled with NMR, Dynamic Nuclear Polarization (DNP) allows, thanks to polarizing agents, the enhancement of NMR signals from a wide range of molecules resulting in the significant reduction of the NMR acquisition time. It shows therefore strong advantages over "classical" NMR and possibly over X-ray diffraction techniques used to characterize proteins on synchrotron type equipments.

NMR has also known an impressive development in the medicine with the development of Magnetic Resonance Imaging (MRI).

Up to now, the DNP has been efficiently applied to MRI for the early diagnosis of cancers in small animals (rats and porks) in preclinical studies and more recently to 30 human patients having prostate cancers. However, MRI using DNP can not be generalized to human diagnosis as polarizing agents used to activate biological tracers/contrast agents need to be quantitatively separated from the polarized solution before human injection and image acquisition. This technical hurdle is now fixed.

In this context, an innovative powder for the easy polarization of many molecules, including biological tracers, was developed in the frame of a European collaboration involving the Laboratory of Chemistry, Catalysis, Polymers and Processes (UMR 5265-LC2P2), the European Center for high field NMR (UMR 5280, CRMN-Lyon) and ETH Zurich. These innovative "powders" open perspectives for the fast characterization of complex systems by means of solid state NMR using DNP but also in the field of medical imaging for early cancer diagnosis using MRI. In this latter field, the aforementioned materials can deliver a solution of polarized biological tracers /contrast agents free from any impurity and therefore injectable to humans.

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