NMR Transversal Relaxivity of Aqueous Suspensions of Particles of Ln^{3+}-Based Zeolite Type Materials

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A series of zeolite-type silicates containing stoichiometric amounts of Ln^{3+} ions in the framework (Ln-AV-9 materials), with composition $(Na_4K_2)(Ln_2Si_{16}O_{38}).10H_2O$ (Ln = Nd, Sm, Eu, Tb, Gd, Dy) has recently been synthesized and characterized (Fig.1). They form paramagnetic microparticles, which as aqueous suspensions have negligible water ^1H longitudinal relaxivities (r_1) for all Ln^{3+} ions studied and quite large transverse relaxivities (r_2) [1]. In this work we further analysed the size distribution of the Ln-AV-9 particles and their r_2* and r_2 relaxivities [2]. The r_2* relaxivity effects are explained by the Static Dephasing Regime (SDR) theory. The r_2 relaxivities appear to be strongly dependent on the interval between two consecutive refocusing pulses (τ_{CP}) in the train of 180° pulses applied. For long τ_{CP} values, the r_2 of the systems saturates at a value, which is always an order of magnitude smaller than r_2*. These features are explained by a crude model, which takes into account the residual diffusion effect in the static dephasing regime. The large microparticles, although not efficient in T_1 relaxation, are quite effective in enhancing T_2 relaxation, particularly at high magnetic fields. The r_2* values and the saturation values for r_2 were found to increase linearly with B_0 and μ_0^2 (Fig. 2). The largest transversal relaxation rate enhancements were observed for Dy-AV-9 with a saturation value of r_2 of 60 s^{-1} mM^{-1} and a r_2* value of 566 s^{-1} mM^{-1} at 9.4 T and 298 K.

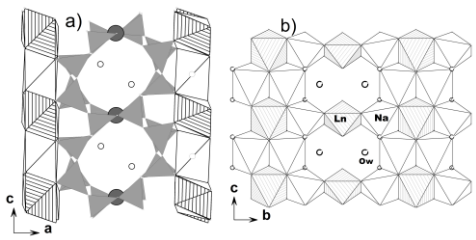

Fig.1

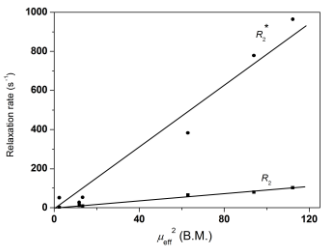

Fig. 2

[1] Pereira, G.A.; Ananias, D; Rocha, J.; Amaral, V.S.; Muller, R.N.; Vander Elst, L.; Tóth, É.; Peters, J.A.; Geraldes, C.F.G.C., *J. Mater. Chem.*, **2005**, 15, 3832.
[2] Pereira, G. A.; Norek, M.; Peters, J.A.; Ananias, D.; Rocha, J.; Geraldes, C.F.G.C., *Dalton Trans*, **2008**, 2241.

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