Pulse NMR of $^3$He in bulk and powder aerogel

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In the present work experimental data of $^3$He pulse NMR in silica bulk aerogel (95%, presented by N.Mulders) and aerogel powder (EM-POWER Co.,LTD, size distribution 5-40 mkm) in a Larmor frequency range 5-20MHz and temperature range 1.5-4 K are reported. We have investigated the $^3$He spin kinetics directly in adsorbed layer. The spin-lattice relaxation time is linearly proportional to frequency, while spin-spin relaxation time is frequency independent in adsorbed, gaseous and liquid phases in both type of aerogel. We didn’t observe the dependence of $T_1$ and $T_2$ of adsorbed $^3$He on number of atoms on aerogel surface. The magnetic relaxation of whole spin system (gas and liquid phases) takes places directly by $^3$He adsorbed layer. We didn’t find out changes of magnetic relaxation times of $^3$He in aerogel at temperature range 1.5-4 K. The $T_1$ and $T_2$ of gaseous $^3$He increases on the order of magnitude if the surface of aerogel is covered by monolayer of $^4$He. Thus, the aerogel is a system in which the relaxation of the filling liquid or gaseous $^3$He proceeds only through the adsorbed surface layer. To explain the observed behavior of the longitudinal relaxation rate, a theoretical model of relaxation in the adsorbed layer of $^3$He taking into account the filamentary structure of the aerogel is proposed.

Section: Quantum Fluids, Helium-3, Helium-4

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