

and macromolecules within the cell plays an important role in cellular phenomena. There are two opposing views on the state of cellular water. The "classical" view maintains that the bulk of the cell water is in a state equivalent to pure water. An opposing view maintains that a substantial fraction of the cell water differs in physical properties from free water. Previous high-resolution NMR studies have shown line-broadening that has been associated with structural changes in the cell water. We have used pulse methods to measure the relaxation times and diffusion coefficients for water in rat skeletal muscle. Measurements on four different animals give the following results. $T_1 = 730 \pm 70$ ms, $T_2 = 46 \pm 2$ ms, $D = 1.5 \pm 2 \times 10^{-5}$ cm²/sec. For pure water, we obtain $T_1 = 3.0$ s, $T_2 = 1.5$ s, $D = 2.8 \times 10^{-5}$ cm²/sec. The implications of these results for the structure of the cell water will be discussed.

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BE 3. Pressure Dependence of Internal Rotation in FeSiF₆·6H₂O* G. L. Nicolaidis and R. W. Vaughan, California Institute of Technology and D. D. Elleman, Jet Propulsion Laboratory - Molecular motion in ferrous fluorosilicate (FeSiF₆·6H₂O) has been studied as a function of pressure to 80 kilobars using conventional wide-line nuclear magnetic resonance techniques. This material has a slightly disordered CsCl structure with SiF₆⁻ and Fe(H₂O)₆²⁺ groups occupying the lattice sites. Second moments calculated from the P¹⁹ spectra indicate the rapid reorientation of SiF₆⁻ octahedra at room temperature and pressure slows with the application of pressure. Second moments approaching the estimated rigid lattice values are obtained near 70 kilobars.

In addition to a detailed discussion of these results a brief discussion of the high pressure cell developed for these studies will be given.

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BE 4. EPR Studies of Np⁴⁺ in ThO₂* R.P. RICHARDSON[†] and J.B. GRUBER, Washington State Univ.--The EPR spectrum of Np⁴⁺ in ThO₂ has been investigated, principally at 1.7°K in the K-band. Three basic Zeeman resonances are energetically isotropic about one [001] crystal axis, with g values 2.02, 2.31, and 2.48. These resonances appear to come from three sites in which the Np⁴⁺ ions are slightly displaced along the [001] axis from the usual O_h point group site. A final basic Zeeman resonance, isotropic about the [110] crystal axis with g=2.06, is thought to arise from a fourth site in which the Np⁴⁺ ion is displaced along the [110] axis. The splittings of the cubic field ground F₈ quartets that arise due to these four axial displacements must be between 5cm⁻¹ and 20cm⁻¹ in order to fit the EPR and optical data. The parameter α , related to the cubic portion of the crystal field, is found to be $\alpha = -0.667, -0.631, -0.604$ and -0.661 for the four nearly cubic sites. The hyperfine lines are fit best with $(390 \pm 30) \times 10^{-4}$ cm⁻¹ for the absolute value of the hyperfine coupling constant.

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BE 5. Nuclear Spin Diffusion in Nonconducting Magnetic Impurities in Nonconducting Solids

PHILIP HORVITZ, Rice Univ.*--It is shown that paramagnetic impurities can induce nuclear spin diffusion in nonconducting solids inside the so-called "barrier radius." The static field created by the impurity spin splits the states $|1/2, -1/2\rangle$ and $|-1/2, 1/2\rangle$, where the quantum numbers refer to the component in the direction of the external magnetic field of two neighboring spins. The nuclear dipole-dipole interaction mixes these two states so that to first order $\Psi_1 = |1/2, -1/2\rangle + \epsilon |-1/2, 1/2\rangle$, and $\Psi_2 = |-1/2, 1/2\rangle - \epsilon |1/2, 1/2\rangle$. The Fourier component of the impurity spin at the frequency corresponding to the energy difference of Ψ_1 and Ψ_2 causes transitions between these states. This is a spin diffusion process because ϵ is small. Typically the induced nuclear spin diffusion is on the order of 10^{-12} cm²/sec. Thus, Bloembergen's differential equation should include spin diffusion inside the "barrier radius."

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BE 6. Theory of Pressure-Induced Demagnetization of Porous Polycrystalline Cubic Ferrites* DENNIS E. GRADY and G. E. DUVALL, Washington State Univ.--A theory is presented which predicts the demagnetization of porous cubic ferrites induced by hydrostatic pressure for values of applied field which would normally saturate the magnetic material. The theory considers magneto-elastic coupling with the deviation in local strain field due to the porosity. Agreement is found with existing data on nickel ferrite, manganese ferrite and yttrium iron garnet.

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BE 7. Clustering and Magnetic Behavior in Au-Fe Alloys* R. J. BORG and C. E. VIOLET, Lawrence Rad. Lab., Univ. of California, Livermore.--

We have been able to induce, by various heat treatments, significant variations in the magnetic response of Au-16.6 at.% Fe alloys which were examined using the Mossbauer effect.

The following are the salient results: (1) there is no discrete ordering temperature for either the quenched or annealed state, (2) the temperature dependence of the magnetic hfs cannot be even approximated by a Brillouin function, (3) the isomer shift does not change detectably with heat treatment, and (4) the splitting of the magnetic hfs for the quenched state is greater than for the annealed state except at the lowest temperature, at which they are equal.

Alloys more dilute in Fe behave otherwise, demonstrating relatively sharp ordering temperatures, Brillouin-like temperature dependence, and no detectable response to varying temperature.

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