the applied vibration the nearer the data tended to the curve *ABC*.

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CHEMISTRY

Paramagnetic Relaxation of Trapped Hydrogen Atoms in Irradiated Frozen Solutions

IN a recent paper[1] we showed how paramagnetic relaxation experiments can give new insights into the nature of the trapping sites of trapped radicals and ions. Trapped electrons in irradiated alkaline ices show no change in their relaxation time over a range of radiation dose from 0·2 to 3 Mrads; this implies that the electrons are trapped in spurs[1]. This communication reports relaxation time measurements on trapped hydrogen atoms which show just the opposite effect; the relaxation time decreases with dose in the range 0·5–5 Mrads.

Hydrogen atoms were first trapped at 77° K in irradiated sulphuric, phosphoric and perchloric acids[2]. Later it was found that hydrogen atoms could be trapped at 77° K in irradiated solutions of a variety of oxyanion salts such as sodium hydrogen sulphate[3]. Scavenging experiments give good evidence that a mobile electron, e_m^-, is the precursor of trapped hydrogen atoms in many of the oxyanion systems (see equation (1)). It is postulated that the hydrogen atom

$$e_m^- + \left[HSO_4^-\right] \longrightarrow \left[HSO_4^{=}\right] \longrightarrow H_t + SO_4^{=} \qquad (1)$$

is trapped at the point at which e_m^- reacts with the oxyanion. If so, the hydrogen atom should be the only paramagnetic species in the local region of the trapping site; that is, one expects the site trapping the hydrogen atom not to be located in a "spur" produced by radiation.

This communication describes paramagnetic relaxation experiments which test this postulate.

Frozen solutions of 8 molar sulphuric acid and deuterium sulphate were irradiated at 77° K with cobalt-60. The slow passage progressive power saturation was measured with an electron paramagnetic resonance spectrometer at a modulation frequency of 40 c/s over a power range of 40 dB.

The interpretation and analysis of power saturation curves due to homogeneous and inhomogeneous broadening have been discussed by Portis[4], Castner[5] and Noble and Markham[6]. Our experimental atom power saturation curves for hydrogen and deuterium are nearly homogeneous in shape. Careful line shape and linewidth measurements in conjunction with power saturation do, however, show that homogeneous and inhomogeneous contributions to the linewidth are comparable[7]. We have determined the relaxation time, $(T_1T_2)^{1/2}$, from the saturation curves by the methods outlined by Portis[4] and by Castner[5]. T_1 is the spin-lattice relaxation time and T_2 the spin–spin relaxation time.

We find that $(T_1T_2)^{1/2}$ for hydrogen atoms decreases from $4{\cdot}6 \times 10^{-5}$ sec at 0·5 Mrad to $1{\cdot}4 \times 10^{-5}$ sec at 5 Mrad. $(T_1T_2)^{1/2}$ for deuterium atoms shows a similar decrease. This result shows that the spin–spin interaction of the trapped hydrogen atoms depends on dose at low doses. If H_t is trapped in a radiation produced "spur" $(T_1T_2)^{1/2}$ would be independent of dose at low doses, as is found for trapped electrons in irradiated alkaline ices[1]. If H_t is not trapped in conjunction with another spin in the same local environment (that is, is not trapped in a "spur") its spin–spin interaction will involve all like spins in the samples. Thus $(T_1T_2)^{1/2}$ will decrease with radiation dose as formed here. We conclude that H is not trapped in a "spur". This finding strongly supports mechanism (1).

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IMMUNOLOGY

Rejection of Skin Grafts from Tumour-bearing Syngeneic Donors

WHEN skin from mice bearing certain transplantable tumours was grafted to intact strictly syngeneic animals of the same sex, regular rejection of the skin grafts was observed. We called this phenomenon heterogenization or allogenization of skin under the effect of the tumour.

C57BL/6J, *BALB/c*, *C3HA* and (*C57BL/6J* × *BALB/c*) F_1 mice from the AMS breeding farm in the Soviet Union were used in the experiments. In *C57BL/6J* mice we transplanted *K*-237 sarcoma induced in our laboratory in a female mouse with 7,12-dibenz(*a*)anthracene and carried through between seven and nine syngeneic transplantations. We also transplanted *K*-238 sarcoma induced with the same carcinogenic agent in a male *C57BL/6J* mouse and carried through between two and three transplantations. *SB*-1 sarcoma induced by the same carcinogen in *BALB/c* mice was transplanted in these mice. It had two to three syngeneic transplantations. Also used were transplantable hepatoma 22 of *C3HA* mice and Ehrlich carcinoma passaged in *C57BL/6J* mice.

Solid tumours in donor mice reached a size of 3 × 2 × 1·5 cm; they grew without gross invasion of the surrounding tissues. Recipients, under 'Nembutal' anaesthesia, received full thickness skin grafts, 3 × 4 cm in size, taken from beyond the zone of tumour growth. The condition of the skin graft was recorded until about day 150 of the experiment.

Syngeneic grafting of skin from *C57BL/6J* mice bearing *K*-237 tumour to intact recipients resulted in regular rejection of the transplants (Table 1). When the graft-fixing adhesive band fell off, usually 6–7 days after transplantation, the area of the grafts had shrunk considerably and there were numerous foci of necrosis. By the fifteenth to twentieth day graft rejection was complete, and a small scar remained. The pattern of rejection is similar both macroscopically and histologically to that