The Electron Spin Resonance of Sodium Polyphosphate Labeled with ^{32}P

By Masaji MIURA and Akinori HASEGAWA

(Received August 13, 1964)

Many substances, such as alkali halides, glasses and so on, become colored upon irradiation with X-, γ- or β-rays. In the literature no reports have been found, however, on the coloration of a substance by the internal irradiation from its radioactive constituent. We have recently found that sodium polyphosphate labeled with ^{32}P (SPP*) becomes red on standing but that the color fades away when it is heated to 200°C. We also studied this substance by means of a ESR technique and found that the absorption bands of ESR are closely related with the red color of SPP.*

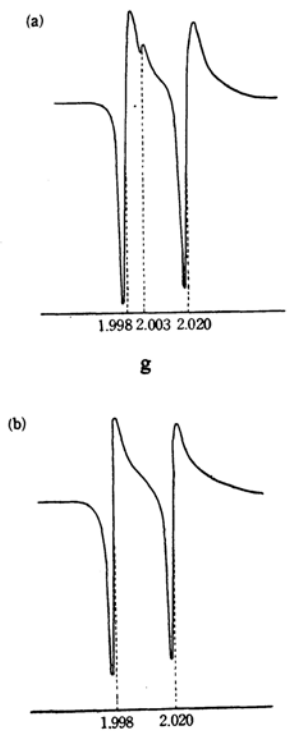

Fig. 1. ESR spectra at 77°K:
(a) SPP*, (b) SPP irradiated with X-rays.

Sodium polyphosphate (SPP), the so-called Graham salt, was prepared by heating sodium dihydrogen phosphate at 800°C for 6 hr. and then cooling rapidly on dry ice.

SPP irradiated with X-rays from a copper target gave two absorption bands of ESR, at $g=1.998$ and 2.020 (Fig. 1b), while SPP itself showed no absorption bands. On the other hand, SPP* exhibited one weak shoulder, at $g=2.003$ (Fig. 1a), in addition to two strong absorption bands, as in the case of SPP irradiated with X-rays. When SPP* was heated at 150°C for 20 min., its color became faint and the shoulder in ESR sbsorption band disappeared; the remaining two bands are of the same shapes as those of irradiated SPP. The intensity of each of two bands was similarly reduced by the heat treatment. It seems, therefore, that these two bands have the same origin. On the other hand only one absorption band was obtained from SPP* which had been prepared by using ^{32}P, a large part of which had already decayed to ^{32}S. This band corresponds to the shoulder in Fig. 1. a.

This conclusion follows from these results: SPP* as well as irradiatd SPP has two absorption bands, at $g=1.998$ and 2.020, which may be the hyperfine structure arising from the interaction of a trapped electron with a phosphorus nucleus (^{31}P, $I=1/2$), as has already been pointed out.[1] Further, SPP* has a shoulder, at $g=2.003$, which may result from a free electron near the sulfur atom (^{32}S, $I=0$) which is the decay product of ^{32}P. This is supported by the fact that the radical of sulfur is easily produced by the irradiation.

Full details will be published later.

Department of Chemistry
Faculty of Science
Hiroshima University
Hiroshima

1) G. O. Karapetyan and D. M. Yudin, *Fiz. Tverd. Tela*, 3, 2827 (1961); Y. Nakai, This Bulletin, 37, 1089 (1964).