

Paramagnetic Resonance Absorption of Coals and Coal Extracts

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Distinct paramagnetic resonance absorption has been observed in British and French coals^{1,2,3}. As the nature of Japanese coal is regarded to be particular in many respects as compared with European one, it was considered worth while to enquire whether or not Japanese coal shows this absorption.

The paramagnetic resonance absorption was measured for a British coal as well as for eighteen samples from Hokkaido mines by use of a micro-wave of 3.2 cm. wavelength⁴, the dielectric properties of Hokkaido coals having been reported elsewhere^{5,6}.

Paramagnetic resonance absorption peak with high intensity and narrow width was detected in all the samples examined. The amplitude of Japanese coal was somewhat less than that of the British specimen (Compare the height of the peaks on the left side of the photographs).

By heating the coals at 270°, 330°, 380°, 430° and 460°C, the height of the line was increased gradually with the elevation of temperature. The extracts and residues of the coals by pyridine, as well as the coal specimens heated up to 460°C were also examined and all of them showed the paramagnetic absorption.

It would be premature to discuss whether or not this absorption is ascribed to 'free radicals' of broken bonds¹ or to some other paramagnetic compounds similar to violanthrone and violanthrene^{4,7}, but it appears certain from this experiment that the problematic substance embracing unpaired electrons is fairly stable against the attack of pyridine solvent.

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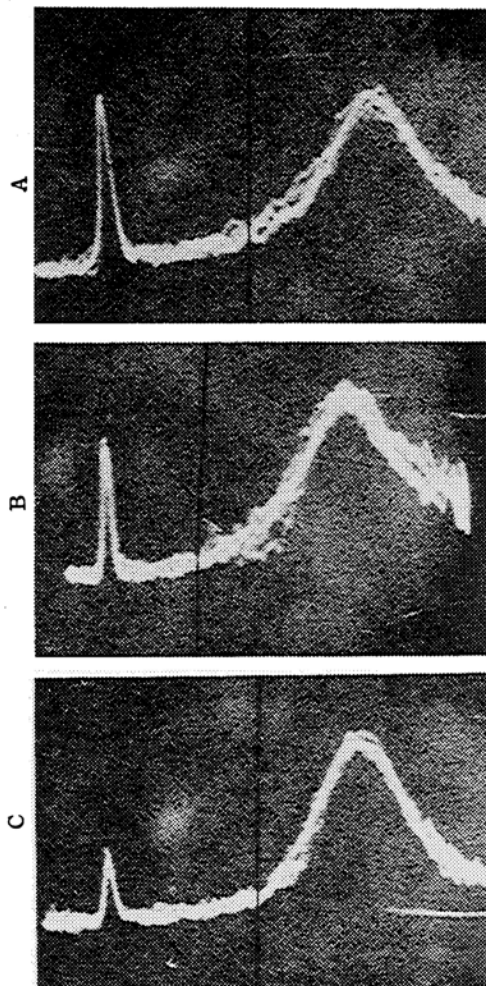


Fig. 1. Oscilloscope trace: absorption spectrum of coal and its pyridine extract. The hills seen on the right side are due to the absorption of cupric sulfate which was added as a standard.

A, British coal (Durham): fixed carbon 71.31, volatile matter 26.14, moisture 0.85, ash 1.70%.

B, Japanese coal (Yubari): fixed carbon 49.41, volatile matter 41.98, moisture 1.50, ash 7.11%.

C, Pyridine extract of B: C 84.50, H 6.48, O+N+S 7.73, ash 1.29%.

1) J.E. Bennett, D.J.E. Ingram and J.G. Tapley, *J. Chem. Phys.*, 23, 215 (1955).

2) J. Uebersfeld, A. Étienne and J. Combrisson, *Nature*, 174, 614 (1954).

3) A. Étienne and J. Uebersfeld, *J. Chim. Phys.*, 51, 328 (1954).

4) Y. Yokozawa and I. Tatsuzaki, *J. Chem. Phys.*, 22, 2087 (1954).

5) I. Miyasita, R. Miura and K. Higasi, *This Bulletin*, 28, 148 (1955).

6) I. Miyasita, *Bull. Res. Inst. Appl. Elec.*, 5, 123 (1953); 6, 117 (1954); 7, 17 (1955).

7) H. E. Blayden, J. Gibson and H. L. Riley, *J. Inst. Fuel*, Wartime Bulletin, 117 (1945).

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