

Structural and Electrical Properties of Iron (II) Tantalate.

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Search through the literature revealed that very little work has been reported on the electrical properties of compounds having a general formula AB_2O_6 . Therefore we have made X-ray structural study of Iron (II) Tantalate ($FeTa_2O_6$) and determined its electrical properties such as resistivity, dielectric constant, and thermo e.m.f. to study the type of conduction.

Pellets of the Tantalate were prepared from the component oxides using standard ceramic techniques, and fired at 1100° for 24 hrs, and at 1350° for 5 hrs. in air. The pellets were quenched finally to room temperature.

The X-ray powder photograph of the sample was taken by a 14 cm. diameter Debye-Scherrer camera with Fe-K α -radiation. Past work¹ showed, that the X-ray pattern was indexed on the basis of Tetragonal symmetry. In the present work, however we could index on the basis of Orthorhombic symmetry with the following lattice dimensions :

$$a = 5.738 \text{ \AA}, \quad b = 15.05 \text{ \AA}, \quad \text{and} \quad c = 5.230 \text{ \AA}.$$

The D.C. resistivity of the sample was determined by a Leeds and Northrup high precision Jones Conductivity bridge in the temperature ranges (a) $25-200^\circ$ with In/Hg amalgam electrodes and (b) $25-500^\circ$ with Ag electrodes.

The resistivity-temperature relationship obeys Wilson's law :

$$\rho = \rho_0 \text{Exp} (\Delta E/KT)$$

The room temperature resistivity of the sample was 6×10^5 ohm cm and reduced to 90 ohm cm at 500° . The activation energies for the two temperature ranges cited were 0.3024 and 0.2796 ev. respectively (Fig. 1). The electric conduction seems to take place through hopping of charge carriers from Fe^{2+} to Fe^{3+} ions in the octahedral sites². The thermo-electric measurements showed the sample to be predominantly 'n' type in the above temperature range.

1. Tavora and Peixoto, *An. Acad. Brasil*, 1951, C₁, **23**, 449-54.

2. E. J. W. Verwey, P. B. Braun, E. W. Gorter, F. C. Romeijn and J. H. Van Santen, *Z. Phys. Chem.*, 1951, **198**, 6.

The capacity of the pellets was determined by using the general radio capacitance bridge. It was observed that the intrinsic values of the dielectric constant increased with the temperature. This behaviour was explained by extending Koop's³ mechanism, and

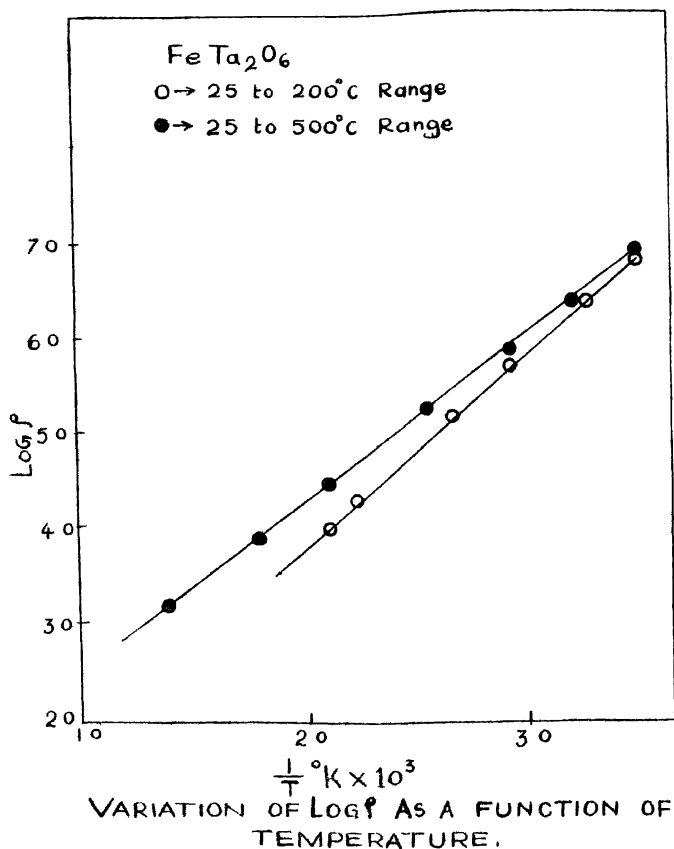


Fig. 1

considering our samples to be equivalent to a circuit composed of a number of parallel resistances and capacitances connected in series. On this basis the theoretical values were calculated and fair agreement was observed with the experimental ones. (Table).

TABLE
Dielectric constants of Iron (II) Tantalate

Temperature in °K	298	342	415	489	551	606	692	769
Experimental	8,712	9,684	10,112	10,484	10,989	11,212	11,964	12,544
Theoretical	8,864	9,774	9,976	10,513	10,663	11,554	12,584	12,888

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3. C. G. Koops, *Phys. Rev.*, 1951, **83**, 121.