

FIG. 1. Absorption spectrum of S_2O .

wavelength side become diffuse. The intensity of these bands increases towards higher members of various progressions, reaches a maximum and falls off again. The fact that the band system is extensive suggests that the S_2O molecule undergoes a large change in its geometry as it goes from its ground electronic state to the excited electronic state. The 0-0 band, which was observed by Phillips *et al.*⁸ at 29285 cm^{-1} in their matrix isolation studies of this band system, has not, however, been observed by us presumably because it is very weak. Assuming the same band origin, all the bands photographed in the present studies could be arranged into six progressions designated as A, B, C, D, E and F. Five of these arise out of 000 vibrational level of the ground electronic state to the excited electronic state involving ν_1' , ν_2' and ν_3' vibrational levels. The remaining one, namely, the B progression, starts from $\nu_1'' = 0$, $\nu_2'' = 0$ and $\nu_3'' = 1$ vibrational level and joins onto several quanta of ν_3' with $\nu_1' = 0$, $\nu_2' = 0$. The progressions D, E and F involve the excitation of ν_1' vibrational mode with $\nu_1' = 1, 2, 3$ respectively over each of which are superposed the ν_3' vibrations extending to high values of ν_3' . The C progression, on the other hand, involves the excitation of one vibrational quantum of the bending mode (ν_2) in the upper electronic state with the simultaneous excitation of several ν_3' quanta. Parts of the A, B, C, D and E progressions are indicated in Fig. 1. The bands belonging to the F progression are overlapped by other stronger bands in the spectrum shown in Fig. 1. Bands of this progression on the shorter wavelength region, however, are easily discernible. Vibrational frequencies in the ground and excited states are summarised in Table I.

TABLE I
Vibrational frequencies of S_2O (in cm^{-1})

	Ground state (from infrared absorption spectrum)	Excited state (from electronic absorption spectrum)
ν_1 , S—O stretch ..	1165	1035
ν_2 , S—S—O bend ..	397	281
ν_3 , S—S stretch ..	679	420

Details of these studies will be published elsewhere.

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ESTIMATION OF NITROGEN IN CHROMIUM

NITROGEN in metals is usually estimated by converting it into ammonia by the Kjeldahl method¹ and later determining the ammonia produced. Nessler's method is one of the simplest methods of ammonia estimation. Kruse and Mellon² have given a survey of the literature indicating the sources of interference, in the Nessler's method. Accurate estimation of nitrogen below 10 ppm is necessary when dealing with chromium where it is an embrittling impurity. Since ammonia is isolated by distillation in the Kjeldahl's method, there is no problem of interference. This communication briefly sets out the limits and precision of estimation of nitrogen in chromium metal obtainable by a combination of Kjeldahl and Nessler's method. To ensure high sensitivity reproducibility and reduce combination by extraneous ammonia, the Nessler's reagent is prepared from Analar grade chemicals and ammonia-free double distilled water. The reagent is kept in dark for a week, filtered and stored in dark coloured bottles. This reagent is quite stable for a month. The ammonia-Nessler's reagent mixture requires ten minutes for full colour development for concentrations above 0.5 ppm and thirty minutes for concentrations below 0.5 ppm. Once the colour is fully developed the colour is quite stable. To counteract the absorbance due to the reagent, all absorbance values are measured with reference to a blank made with ammonia-free water in the place of the sample. Taking these precautions and measuring the absorbance at wavelength 410 nm, we find that the absorbances of 0.04 ppm and 0.4 ppm solutions are 0.0467 (5 cm cell) and 0.085 (1 cm cell) respectively. The standard deviations are 0.0033 and 0.001 respectively giving a corresponding c.o.v. of 6.8 and 1.08.

In our experience we find that using a combination of Kjeldahl's and Nessler's methods, nitrogen in chromium can be estimated down to 0.5 ppm with 1 cm cell and 0.1 ppm with 5 cm cell for a 1 gm sample and 10 ml distillate.

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