RADIATIONS FROM HIGHLY IONIZED ATOMS IN PULSED GAS DISCHARGES

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INTRODUCTION

This paper presents a summary of the analysis of spectra emitted by pulsed gas discharge tubes. The investigation was originally undertaken to ascertain the degree of excitation achieved in the pulsed gas discharge.

EXPERIMENTAL DETAILS

The spectra were obtained on two separate quartz spectrographs at the University of Oklahoma. Four spectrograms have been analysed by wave-length measurements using iron as the reference spectrum. Two spectrograms were taken on a small quartz spectrograph, using as source a tube with aluminum electrodes; the others were taken on a Hilger E-1 spectrograph with a tube having copper electrodes. One of each pair was taken at low pressure (order of a few tenths millimeter of Hg); the others were taken at higher pressures (order of a few mm. of Hg). The small quartz spectrograph covered the range 5000 A to 2200 A; the E-1 was used for the range 2500 A to 2000 A. The low-pressure spectrum with aluminum electrodes is quite complex; many of the lines on this plate remain unidentified. The other spectra are simpler, and most of the lines on them have been identified.

RESULTS

1. HIGH PRESSURE SPECTRUM WITH ALUMINUM ELECTRODES. This spectrum contains mostly lines of neutral atoms, among them mercury, silicon, boron, and carbon. In addition, a pair due to C II appears, as well as the very strong line due to C III at λ2296.7. An interesting feature of the spectrum is the appearance of three lines at λ2288.3, λ2266.2 and λ2228.5, which so far have not been identified.

2. HIGH PRESSURE SPECTRUM WITH COPPER ELECTRODES. This spectrum shows lines due to C I, C II and C III. Numerous lines of O II and Hg are also present.

3. LOW PRESSURE SPECTRUM WITH COPPER ELECTRODES. This spectrum shows some outstanding features. There are two lines of O II and many lines of Cu II. The strongest line is λ2296.7 of C III, which is the only line appearing on a short exposure. C I is quite prominent. Lines of B I and B II appear, as well as the extremely strong pair λ2067.9, λ2066.4 of B III. There are lines due to Si I. A very strong line at λ2287.1 is due to Si IV; a strong pair at λ2449.5, λ2450.0 is due to O IV. Several faint lines have not yet been identified.

4. LOW PRESSURE SPECTRUM WITH ALUMINUM ELECTRODES. This extremely complex spectrum has not been completely worked out. Definite identifications have been made in C I, C II, C III, and C IV. Identifications have also been made in Al I, Al II, and Al III; Mg I and Mg II; Si I, Si II, Si III, and Si IV; B I and B II, as well as O IV and possibly O III. The persistent lines of Cu II are present. The unidentified line at λ2266 is present, but the line at λ2229 is absent.

DISCUSSION

The identifications indicate that the level of excitation is quite high. It requires 94.2 volts to excite the line λ2287.1 of Si IV, while the pair at λ2450 in O IV requires more than 167 volts. This type of source offers good possibilities for the excitation of spark spectra of elements not obtainable in the form of metals.