Spectroscopy of Cesium Pulsed High Pressure Discharge

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One of the reasons for the cesium high pressure light source will probably not be the next to sodium high pressure lamp is the near infrared location of the first resonance lines, at 852 and 894 nm. However, at relatively high cesium densities they are so much absorbed at walls of the alumina burner, that this effect actually minders the infrared losses of such cesium discharge.

The previous research definitely showed that a pulsed discharge caused the rise of the recombination continuum and simultaneous broadening of Rydberg spectral lines, that the time averaged spectrum obtains the black body shape with temperature close to 4000 °C [1]. It was shown that such white light source could be also dim retaining its general shape [2]. We investigated some other possible points in further development which are partially published in reference [3].

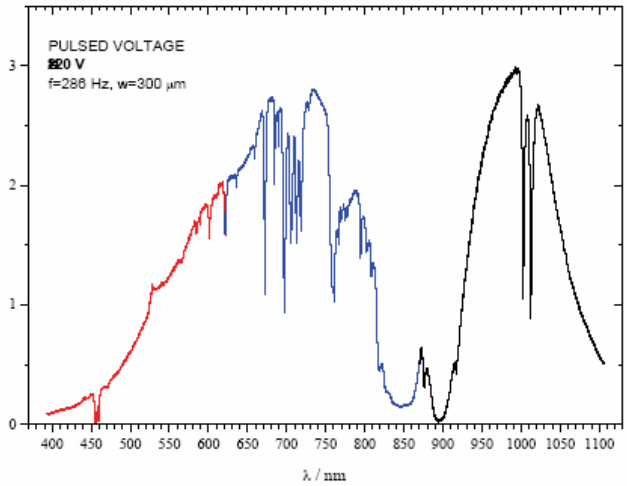

Fig. 1. Visible and near infrared spectrum of pulsed cesium lamp.

New spectroscopic investigations have been performed using compact digital spectrometer (OceanOptics HR4000), which enabled measurements beyond 1000 nm. Beside this some measurements with a scanning monochromator have been extended to 2000 nm. The FTIR measurements have been also performed and revealed very interesting near-infrared spectral features, mainly responsible for the energy losses.

Prominent satellite bands, excimer emission of cesium dimer, and atomic lines in the near infrared spectral region will be presented and discussed, by means of the molecular and atomic structure.

Infrared emission of the pulsed cesium lamp is dominated by cesium doublet and continuum that is possibly influenced by cesium dimer singlet and triplet emission.

Quantitative studies of the total infrared intensity, which means a lot of energy loss is under way. If this portion of the infrared emission could be returned to plasma and used for additional heating, it might lead to increased efficiency of the lamp in terms of elevated lm/W values.

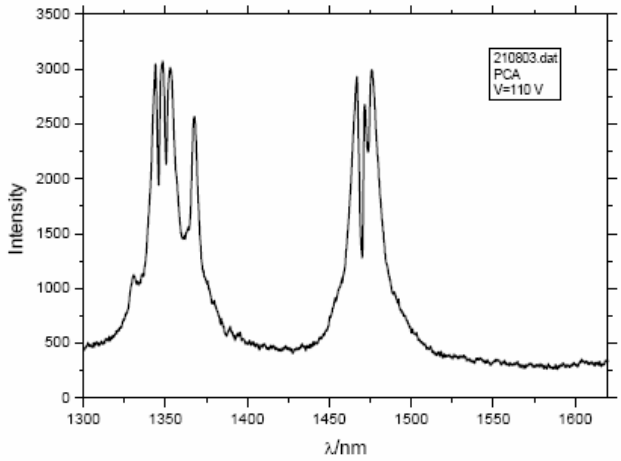

Fig. 2. Infrared cesium doublet lines recorded at 110 V.

We shall report on several infrared spectroscopic studies and additional technological improvements that lead to a better performance of the pulsed cesium high pressure discharge lamp. These new results may promote this lamp as more attractive for white light illumination purposes. Control of infrared emission seems to be essential in all future development.

REFERENCES

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