Cesium pulsed high pressure discharge, spectroscopy and development

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Cesium high pressure light source has no the same chance of becoming most wide spread light source on Earth, like it was the case with high pressure sodium lamp. One of the reasons is the near infrared location of the first resonance lines, being 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 ^{o}C. It was shown that such white light source could be also dim retaining its general shape (Maya). We investigated some other possible points in further development which are partially published in reference [3].

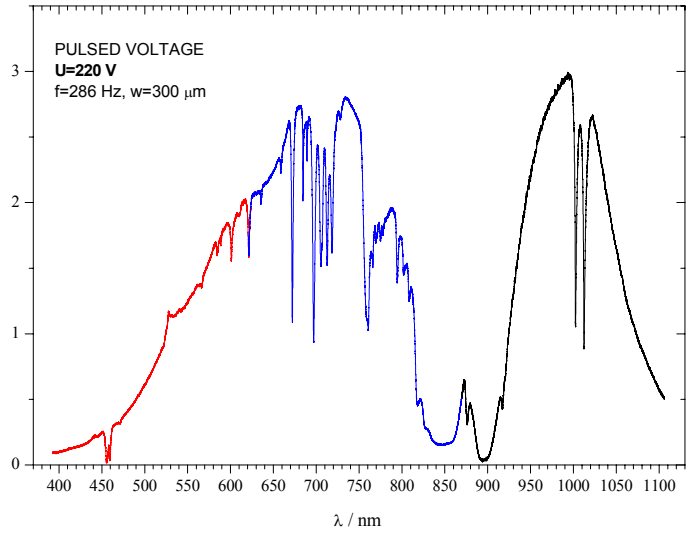

Fig. 1. Visible and near infrared spectrum of pulsed cesium lamp.

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.

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 triplet emission. Although we do not have quantitative values of the total infrared intensity, it certainly means a lot of loss of energy. 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.

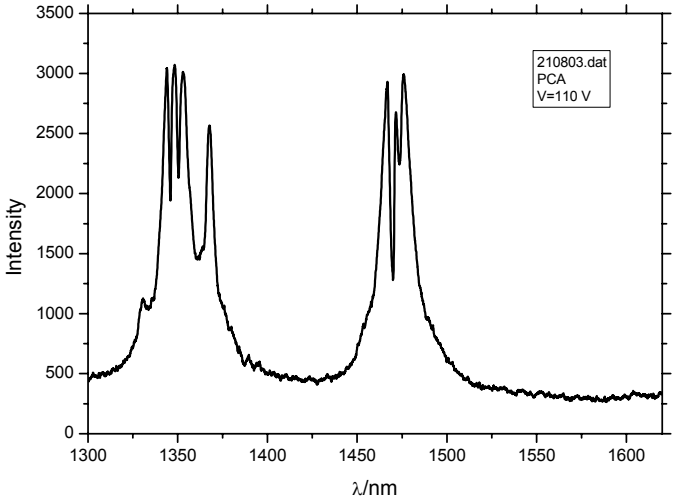

Fig. 2. Infrared cesium doublet lines recorded at 110 V.

There are other possible technological improvements that may be performed in the near future in order to make pulsed cesium high pressure discharge lamp more attractive for white light illumination purposes. Control of infrared emission seems to be essential in all future development.

Literature:

[1] Liu, J., Günther, K., Kaase, H. and Serick, F., Proc. 8th Int. Symp. Science and Technology of Light Sources (Greifswald, Germany, 1998) paper CO2.

[2] H Gu, M E Muzeroll, J C Chamberlain and J Maya, Pulse modulated high-pressure caesium discharge lamp, Plasma Sources Sci. Technol.**10**, 1 (2001)

[3] G. Pichler1, V. Živčec, R. Beuc, Ž . Mrzljak, T. Ban, H. Skenderović 1, K. Günther and J. Liu, UV, Visible and IR Spectrum of the Cs High Pressure Lamp, Physica Scripta, (2003).