P 2 Niedertemperaturplasmen / Plasmatechnologie 1

Zeit: Freitag 11:00–12:30 Raum: HU 3038

Fachvortrag

P 2.1 Fr 11:00 HU 3038

UHP Lamps for Projection Systems — •Pavel Pekarski, Ulrich Hechtfischer, Holger Moench, and Ulrich Weichmann — Philips Research Laboratories, Weisshausstr.2, D-52066 Aachen, Germany

UHP (Ultra High Performance) lamp is a key component for projection systems that allows to achieve highest efficiency for small display sizes. This broadband light source with luminance well above the brightness of the sun (1Gcd) and lifetimes of over 10000 hours is the standard for most commercially available front and rear projectors. Essential features of UHP are mercury pressure above 200 bar (needed for a good spectrum and high burning voltage at small electrode distances) and the implementation of a chemical cycle which keeps the wall clear over thousands of hours of lamp operation. In addition, the UHP electrodes have to deal with current densities of 10kAcm^{-2} and heat loads of 100kWcm^{-2}. It is a major task of UHP electrode design to handle this heat load and realize an electrode temperature low enough to reduce electrode burn-back to a minimum so that the required short arc length is maintained. This talk will span the bridge from projection application requirements to actual plasma lamp research.

P 2.2 Fr 11:30 HU 3038

Study of the Hg line at 185 nm during the warm-up of a high-pressure discharge lamp — •St. Franke, H. Lange, H. Schneidenbach, and H. Schöpp — INP Greifswald, F.-L.-Jahn-Str. 19, D-17489 Greifswald, Germany

The mercury line at 185 nm is of essential importance for the energy balance of high-pressure discharge lamps. Therefore it is necessary to be able to model this line in a correct way using realistic broadening constants. With a VUV-spectrometer the mercury line was measured using a discharge tube made of UV-transmitting quartz. The observed intensities were corrected with respect to the absorption of UV-light by the quartz wall. Looking at the warm-up phase of the high-pressure discharge the establishment of the self-reversion can be observed and contributions to the spectrum around the Hg 185 nm line can be discussed. Taking broadening constants from the literature the validity of these constants is checked by model calculations of the radiation transport.

P 2.3 Fr 11:45 HU 3038

Limitations of Bartels' method for temperature determination in metal-halide arc lamps with self-reversed spectral lines — •H. Schneidenbach, St. Franke, H. Schöpp, and R. Methling — INP Greifswald, F.-L.-Jahn-Str. 19, D-17489 Greifswald, Germany

Self-reversed lines play an important role for diagnostics of high-pressure lamp plasmas. The temperature profile of a plasma column can be determined by the Bartels method [1] from the reversal maxima of the side-on measured line intensities. The method implies some conditions like LTE, constant partial radiator pressure, line shift neglect and exclusion of resonance lines as well as lines with low excitation energy of the lower level. The Bartels parameters have been analyzed for cases without these limitations with given temperature profiles and plasma compositions. Special attention has been turned to the influence of temperature plateaus in the peripheral discharge areas. Some basic aspects have been discussed in comparison with the method described by Karabourniotis [2].

[1] H. Bartels, Z. Physik 128 (1950) 546
[2] D. Karabourniotis, J. Phys. D: Appl. Phys. 16 (1983) 1267

P 2.4 Fr 12:00 HU 3038

Electrical characteristics of low-pressure sine wave driven He-Xe lamps — •Detlef Loffhagen, René Bussiahn, Sergey Gorchakov, and Hartmut Lange — INP Greifswald, Friedrich-Ludwig-Jahn-Str. 19, D-17489 Greifswald

Low-pressure discharges in mixtures of xenon with other rare gases are the most promising substitutes for mercury in light sources for publicity lighting. The main disadvantage of such discharges is their lower luminous efficacy in comparison with mercury lamps. In order to improve the output characteristics an optimization of such parameters like mixture composition, pressure, discharge current and operation mode are necessary. The present contribution deals with the electrical characteristics of sine wave driven He-Xe discharges. Experimental studies and self-consistent model calculations have been performed for mixtures of He with 2% Xe at varying mean current density, gas pressure and frequency. The measured and predicted periodic evolutions of discharge voltage and current are reported. Generally good agreement between experimental and calculated results is found. The ionization and heavy particle kinetics are analysed and the most important properties of sine wave driven discharges are discussed in comparison with square wave pulse operation mode.

Supported by BMBF (FKZ: 13N8153)

P 2.5 Fr 12:15 HU 3038

Untersuchungen zum Kaltstartverhalten von Leuchtstofflampen mittels laserinduzierter Fluoreszenz — •Stefan Hadrath[1], Jörg Ehlbeck[1] und Gerd Lieder[2] — [1]Institut für Niedertemperatur-Plasmaphysik e.V. (INP), F.-Ludwig-Jahn-Str. 19, D-17489 Greifswald — [2]RLS, Osram GmbH, Hellabrunner Str. 1, D-81536 München

Untersuchungen an Leuchtstofflampen sind oft auf die Elektroden fokussiert, da diese die Lebensdauer der Lampe beschränken. Bisherige Forschungen konzentrierten sich auf den Warmstart, bei dem die Wendel vor der eigentlichen Zündung kurz vorgeheizt wird. Vor allem um Kosten zu sparen werden elektronische Vorschaltgeräte (EVG) ohne diesen Vorheizprozess gefertigt. Eine Leuchtstofflampe zündet beim sog. Kaltstart in einer Glimmentladung. Auf Grund des daraus resultierenden hohen Ionen-Beschusses wird Elektrodenmaterial (Wolfram und Emitter) zerstäubt. Dies führt zu Frühausfällen der Lampen infolge Wendelbruchs. Mit Hilfe der hochsensitiven Methode der laserinduzierten Fluoreszenz (LIF) lassen sich absolute Dichten des Wendelmaterials bestimmen. Die Vorteile, z.B. der hohen Ortsauflösung – gegenüber der Sichtstrahlintegration bei Emissions- oder Absorptionsmessungen – und der Unabhängigkeit von Plasmaparametern, rechtfertigen den vergleichsweise aufwändigen Messaufbau. Hauptziel dieser Arbeit ist die Untersuchung des Erosionsprozesses des Wendelmaterials (Wolfram), um die zugrundeliegenden Sputterprozesse besser zu verstehen.