

# **11th International Symposium on the Science and Technology of Light Sources**

**Shanghai, China  
20 – 24 May 2007**

## **Editors:**

**M.Q. Liu  
R. Devonshire**

ISBN: 978-1-5108-4083-6

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2007) by Foundation for the Advancement of the Science & Technology of Light Sources (FAST-LS) All rights reserved.

Printed by Curran Associates, Inc. (2017)

For permission requests, please contact Foundation for the Advancement of the Science & Technology of Light Sources (FAST-LS) at the address below.

Foundation for the Advancement of the Science & Technology of Light Sources  
FAST-LS  
Belmayne House  
99 Clarkehouse Road  
Sheffield, United Kingdom  
S10 2LN

[www.fast-ls.org](http://www.fast-ls.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## List of Invited, Landmark and Contributed Papers

### Special Session

IL01	The Light Source Industry in China <i>Y.S. Chen</i>	3
IL02	Latest Performance of GaN-based Solid State Lighting <i>S. Nakamura</i>	7

### Session One

IL03	A Survey of Fabrication Methods for Ceramic Metal Halide Arc Tubes <i>J. T. Neil and G. C. Wei</i>	11
IL04	Temperature determination from self-reversed spectral lines <i>St. Franke and H. Schneidenbach</i>	23
LL01	Studying dimming characteristics of HID model lamps <i>M. Kettlitz, M. Wendt, S. Peters, H. Schneidenbach and A. Kloss</i>	33
LL02	Some Aspects of Medium Wattage Ceramic Metal Halide Lamps <i>J. Tu, J. van der Eyden and C. Daemen</i>	35
CP001	A Study of the <i>in situ</i> Kinetics of Halogen Lamp Dose Activation <i>R. Jeans, M. van Rijswick, G. Siddons and R. Devonshire</i>	37
CP002	High Watt Ceramic Metal Halide Lamps with Improved Reliability <i>R. Ramaiah</i>	39
CP003	Spatial Illuminance Distribution as a Tool for the Study of Flashlamp Plasma Dynamics <i>M.S. Chen and I. J. Rasiah</i>	41
CP004	Characterization of Getter Materials for HID Lamps <i>A. Corazza, B. J. de Maagt and S. Ceulemans</i>	43
CP005	Characterization of Ba atom emission from fluorescent lamp filament by Laser-Induced Fluorescence technique <i>Y. Manabe, T. Ueda, A. S. Alyhendy, G. Yamashita, Y. Yamagata and K. Uchino</i>	45
CP006	Computer Simulations on Hg-free Flat Fluorescent Lamp (FFL) <i>S. M. Lee, Y. S. Seo, S. J. You and J. K. Lee</i>	47
CP007	Electrode Temperature and Cathode Fall of Dimmed Fluorescent Lamps <i>J.J. de Groot</i>	49
CP008	Determination of Barium Loss in Fluorescent Lamps by Laser-induced Fluorescence supported by Modeling <i>G. Lieder, M. Beck, J. Dichtl, R. Garner, S. Hadrath, A. Hilscher, R. Hoeck, K. Rackow, F. Sigener, D. Uhrlandt and J. Ehlbeck</i>	51
CP009	Study of Direct Current (DC) Fluorescent Lamps (FL) without Flicker <i>Z.P. Lu, W. Xu and Z.M. Zhao</i>	53
CP010	Influence of the arc bowing on the frequency shift of the first azimuthal mode of a CMH lamp in horizontal operation <i>S. Bhosle, L. Dabringhausen and G. Zissis</i>	55

CP011	The effect of dimming ceramic metal halide lamps on lamp efficacy, reliability & lifetime <i>E.C. Guest, M.H. Girach, S.A. Mucklejohn and U. Rast</i>	57
CP012	Investigations on Preparing TiO <sub>2</sub> Coatings for halogen lamps with Tetrabutyl Titanate in Microwave Discharge Plasma <i>D.L. Lu , B. Lafitte , J.R. Chen, G. Zissis and Z.G. Lu</i>	59
CP013	Wide band gap amorphous silicon carbide films deposited by PECVD <i>J. Huran, I. Hotový, J. Pezoltd, N. I. Balalykin and A.P. Kobzev</i>	61
CP014	Nanosecond Pulsed Discharge (NPD) and Applications in Light Sources <i>K.F. Liu, Z. Liu and J. Qiu</i>	63
CP015	Visible continuum emission with high color rendering index from CO inductively coupled plasma <i>T. Takeda, A. Nazri, A. Kondo, H. Motomura and M. Jinno</i>	65
CP016	New High Yield Mercury dispenser for Cold Cathode Fluorescent Lamps <i>P. Gallina, G. Santella, D. Di Giampietro and V. Massaro</i>	67
CP017	Simulation on Electronic Ballast for High Intensity Discharge Lamps by PSIM <i>Y.Z. Zhou , D.Q. Guo and Y.J. Sun</i>	69
CP018	Fabrication and Luminescence Increasing Efficiency of OLED with AZO anode <i>E.M. Jin, K.M. Kim, D.K. Kim and C.B. Park</i>	71
CP019	Fundamental Processes in Modeling Fluorescent Lamps <i>G.G. Lister , A. Rahman , V. Sheverev , J.E. Lawler, D. Fursa and I. Bray</i>	73
CP020	Current crest factor and barium emission on fluorescent lamp electrodes at high and low frequency operation <i>W. Kaiser, R. P. Marques and A. F. Correa</i>	75
CP021	About measuring EEDF and electron concentration in the Hg-Ar discharge <i>M.A. Malkov</i>	77
CP022	The effects of the electronic environment on the operating parameters of the Tungsten Halogen Automotive Lamps <i>L. Makai</i>	79
CP023	Surface analytical study of the ceramic-metal bond in the electrical feed-trough of high pressure sodium lamps <i>G. Dobos, K. V. Josepovits, Z. Tóth, I. Csányi and L. Kocsányi</i>	81
CP024	VUV light sources based on a barrier discharge <i>M.I. Lomaev, D.V. Schitz, V. S. Skakun and V.F. Tarasenko</i>	83
CP025	First experiments with net electrodes in high voltage fluorescent tubes <i>W. Lehmann</i>	85

## Session Two

IL05	Translucent Ceramic Envelope for HID Lamps <i>K. Watanabe</i>	89
IL06	Thermochemical data for light sources <i>T. Markus</i>	99

LL03	Development of High Efficacy Metal Halide Lamp <i>H. Nohara, A. Utsubo, Y. Kanazawa, N. Nishiura and S. Ukegawa</i>	107
LL04	A Compact Microwave Resonant Cavity Electrodeless Light Source System <i>V. Babykumar, A. Neate, E. Odell, B. Preston, A. Sadiq and R. Devonshire</i>	109
LL05	Molecular Influence on Hot-Relight in HID Lamps <i>W.P. Lapatovich, A.B. Budinger, R. Pereyra and G. Lister</i>	111
LL06	Near Infrared continuum radiation from Metal Halide lamps <i>J.E. Lawler and M.T. Herd</i>	113
LL07	Experimental Determination of Parameters for Molecular Continuum Radiation of Rare-Earth Iodides <i>M. Käning, B. Schalk and H. Schneidenbach</i>	115
CP026	Dependence of light fluctuation on operating frequency and filter capacitor of electronic ballast for integrated compact fluorescent lamp <i>Q. Yuan, X.B. Zhuang, H. Jiang and S.D. Zhang</i>	117
CP027	LIF-measurements on a low pressure RF-driven InBr lamp <i>H.C.J. Mulders and W.W. Stoffels</i>	119
CP028	The Optical Design of the Projector Type Headlamp for Vehicle <i>X.J. Song, Q.F. Tu, C.J. Xu and X. Zhang</i>	121
CP029	Study on the Dependence of the Emission Point of Fluorescent Lamp on the Lighting Time <i>T. Uetsuki and H. Miyake</i>	PIC
CP030	Phase resolved investigation of the attachment of ac-arcs in Ar, Kr, and Xe at electrodes for HID-lamps <i>M. Westermeier, J. Reinelt O. Langenscheidt, J. Mentel and P. Awakowicz</i>	125
CP031	Glass Melting Phenomena of Compact Fluorescent Lamps at End-of-Life <i>Y. Watanabe and M. Kinoshita</i>	127
CP032	Intense electron emission from graphite nanoneedle cold cathodes and their application to field emission lamps <i>T. Matsumoto, Y. Go, K. Tanaka, S. Nakamura, and S. Omori</i>	129
CP033	Railway Signal Lamp using High Power LED <i>Q. Yuan and S. Zhao</i>	131
CP034	Secondary electron emission properties of MgO for liquid crystal display backlighting electrode <i>T. Misu, M. Goto and T. Arai</i>	133
CP035	The Influence of the electrode material to the CCFL Characteristics <i>Y. Takeda, R. Kitamoto, T. Uetsuki and O. Fukumasa</i>	135
CP036	Modeling of fluid-mechanical instability in pure-mercury HID lamps <i>T.D. Dreeben</i>	137
CP037	Quantitative interpretation of broadband x-ray absorption imaging of high-intensity discharge lamps <i>J.J. Curry</i>	139
CP038	Lifetime Estimation of High Power White LEDs <i>M. Sugimoto, R. Yokotani, H. Kimura and T. Hashimoto</i>	141

CP039	Heat Extraction Comparison of Low Power High Brightness Light Sources <i>D. Rutan and J. Perkins</i>	143
CP040	Generation of Circularly Polarized Microwaves to Power Electrodeless HID Lamp Systems <i>K.S. Oh, J.J. Kim, K.S. Kim, D.H. Won and H.S. Yoon</i>	145
CP041	Hot restrike characterization of HID lamps using a simple model <i>P. Tant, B. Vanbrabant, J. Driesen and G. Deconinck</i>	147
CP042	Determination of gas temperature of hydrogen containing high-frequency electrodeless lamps using (2-2)Q Fulcher- $\alpha$ bands of H <sub>2</sub> molecule <i>M. Berzins, N. Denisova, Z. Gavare, R. Veilande and N. Zorina</i>	149
CP043	Effect of pre-aging process on nitrogen protection in argon-nitrogen lamps <i>T. Matsuda, K. Yamada, H. Motomura and M. Jinno</i>	151
CP044	Ceramic Electrodes for Mercury-Free Low-Pressure Fluorescent Tubes: A First Approach <i>A.C. Dippel, T. Schneller, W. Lehmann and R. Waser</i>	153
CP045	A Plug&Play LED Light source for Automotive Headlamp Applications <i>Th. Reiners, P. Frey, A. Biebl and R. Vollmer</i>	155
CP046	User Preferences for Solid State Lighting <i>V. Gligor, E. Tetri, L. Halonen</i>	157
CP047	Mercury free backlight for liquid crystal display with new electrodes structure—double helical electrodes lamp <i>H. Motomura, Y. Muguruma, T. Matsuda, S. Takubo and M. Jinno</i>	159
CP048	Optical Design for New Tunnel Luminaires <i>P.F. Li, Q. Yuan, W. Xu, Z.H. Gu and B.Y. Huangfu</i>	161
CP049	The orientation effect on color temperature T <sub>c</sub> of metal halide lamps <i>X.J. Xu and G.X. Zheng</i>	163
CP050	Power Measurement of the Electrodeless Fluorescent Lamp and Analysis on its Core Losses <i>Y. Liu, W.P. Li, Y.M. Chen and D.H. Chen</i>	165
CP051	Evaluation of Low Pressure UV Lamps Using a Near-Field Test Apparatus <i>R. Kilgour and D.G. Knight</i>	167
CP052	Transport phenomena of aluminium oxide in metal halide lamps <i>S. Fischer, B. Huang, U. Niemann and T. Markus</i>	169
CP053	The effects on the characteristics of a 8 × 8 arranged LED BLU driven by constant voltage and current method <i>S.M. Lee, J.K. Yang, S.J. Lee, J.H. Lee, Y.C. Yim and D.H. Park</i>	171

### Session Three

IL07	Transient spots on thermionic arc cathodes I. Modeling <i>M.S. Benilov and M.D. Cunha</i>	175
IL08	Metallurgical mechanism for HID lamp electrodes <i>G. Leichtfried, I. Wesemann, W. Spielmann and T. Walde</i>	177

LL08	Mercury dosing solutions used in Fluorescent Lamps <i>A. Corazza and C. Boffito</i>	193
LL09	New dispenser electrodes for high pressure sodium lamp <i>D.C. Zhu, Z.J. Shi, H.L. Gao and J.K. Sun</i>	195
LL10	Nanocrystalline poly-silicon based ballistic electron emitter and its application to novel mercury-free light sources <i>T. Ichihara, T. Hatai, K. Kamada, T. Komoda and N. Koshida</i>	197
LL11	Mercury Free Metal Halide Lamp <i>Z.M. Yang, G.S. Chai, G.Y. Gao and M. Zhang</i>	199
CP054	Ignition of mercury-free high intensity discharge lamps <i>M. Czichy, J. Mentel and P. Awakowicz</i>	201
CP055	Development of a new Getter Alloy with high sorption performances for HID lamps <i>V. Massaro, A. Corazza and S. Giorgi</i>	203
CP056	High Efficient 2.5 MHz RF Generator for Inductively Coupled Electrodeless Lamps <i>E. Statnic and F. Franck</i>	205
CP057	The next generation of low pressure discharge lamps: Lighting after mercury <i>S. Kitsinelis and E. Fokitis</i>	207
CP058	Plasma diagnosis of xenon fluorescent lamp using laser induced fluorescence spectroscopy <i>Y. Toda, S. Iwaki, Y. Imai, H. Kurokawa, H. Motomura and M. Jinno</i>	209
CP059	Study on the Relationship between the electrode materials and the characteristics of CCFL <i>T. Ohira, T. Uetsuki, Y. Takeda and O. Fukumasa</i>	211
CP060	Identification of 35-W and 70-W metal halide lamps <i>S.Y. Tang, W.T. Tsai, C.S. Moo, C.R. Lee and L.L. Lee</i>	213
CP061	A bibliography of (Alkali iodide - Lanthanide iodide) phase diagrams <i>A.T. Dinsdale and S.A. Mucklejohn</i>	215
CP062	Annealing experiments with different SiO <sub>2</sub> -Glasses <i>E. Arnold, F.J. Schilling and H.D. Witzke</i>	217
CP063	Electric field and 254 nm radiation of T2 low pressure Ar-Hg discharge positive column <i>Q.Y. Han, H. Jiang, S.L. Zhu and S.D. Zhang</i>	219
CP064	Measuring the pressure in ultra-high-pressure mercury lamps <i>U. Hechtfischer, M. Carpaïj, B. Engelbrecht, E. Fischer, A. Koerber, J. Pollmann-Retsch and H. Moench</i>	221
CP065	A direct method to determine the inner values and plasma charge of a DBD <i>K. E. Trampert, M. Paravia and W. Heering</i>	223
CP066	Emission spectra of compact super-high-pressure mercury discharge lamps using antenna-excited microwave discharge <i>T. Mizojiri, M. Kando and Y. Morimoto</i>	225

CP067	Development of a new type CO <sub>2</sub> coherent light source using DBD <i>K. Koyama, T. Akazawa, H. Motomura and M. Jinno</i>	227
CP068	White OLEDs for Lighting Applications <i>H. Boerner and P. Loebel</i>	229
CP069	Electrode stabilized Xe filled Flash Lamp as a DUV and VUV Point Source <i>F. Oda, M. Ikeuchi and Y. Morimoto</i>	231
CP070	A New S model of Mesopic Photometry for Evaluating Luminous Efficacy <i>W.C. Chen, Y.D. Lin and D.H. Chen</i>	233
CP071	Determination of the gas-phase emitter effect in ceramic metal halide lamps <i>O. Langenscheidt, J. Reinelt, M. Westermeier, J. Mentel and P. Awakowicz</i>	235
CP072	X-ray induced fluorescence measurement of the additive and Hg densities in a metal-halide lamp <i>T. Nimalasuriya, J.J. Curry, C.J. Sansonetti, E.J. Ridderhof, A.J. Flikweert, W.W. Stoffels, M. Haverlag and J.J.A.M. van der Mullen</i>	237
CP073	Progress in Basic Spectroscopic data for Rare Earth atoms and ions <i>J.E. Lawler, E.A. Den Hartog, C. Sneden and J. J. Cowan</i>	239
CP074	Basic modeling of an Organic Semiconductor junction <i>S. Bhosle, H. Kanaan, G. Ablart, D. Buso, P. Jolinat, I. Séguy, P. Destruel and G. Zissis</i>	241
CP075	The Characteristics of Electrode-less Lamp's Plasma <i>M. Ueda and T. Uetsuki</i>	243
CP076	Dynamics of the plasma/electrode interface in fluorescent lamps <i>R. Garner</i>	245
CP077	Radiation characteristics of xenon-iodine gas mixture excited by pulse-modulated ICP <i>T. Kadota, M. Watanabe, M. M. Guivan, H. Motomura and M. Jinno</i>	247
CP078	Current waveform optimization of AC-operated short arc ultra high pressure mercury lamps for projection applications <i>T. Tsukamoto, Y. Horikawa and A. Sugitani</i>	249
CP079	Quantification of HCl, HBr and HI in halogen lamps by FTIR spectroscopy <i>M. van Rijswick and A. Koerber</i>	251
CP080	Bulb Discoloration due to Gaseous Impurities <i>T. Gallagher and M. Yang</i>	253
CP081	Plasma Parameters in Cylindrical Type Low-pressure Xenon ICP Lamp <i>A. Nazri, A. Kondo, T. Takeda, H. Motomura and M. Jinno</i>	255
CP082	Dependence of Discharge and Radiation of Small Pulse Xenon Lamp On Starting Conditions <i>C. Lin</i>	257
CP083	Behaviour of PFC-equipped Ballasts in Lighting System <i>J. Václavík and M. Novák</i>	259
CP084	Investigation on various approximations for multi-fluid plasma models of the near-cathode region in thermal plasmas <i>F.H. Scharf, J. Oberrath, P. Mertmann and R.P. Brinkmann</i>	261

CP085	Measurement of Koedam $\beta$ factors of 254 nm radiation in T3 low pressure Ar-Hg discharge positive column <i>H. Jiang, Q.Y. Han, S.L. Zhu and S.D. Zhang</i>	263
CP086	Lamp Diagnostics via Electrodeless Excitation of Fill Gases <i>K. Takahashi and R. Devonshire</i>	265
CP087	Material Transport in Halogen Lamps <i>R.J. Jeans, M. van Rijswick and R. Devonshire</i>	267

#### **Session Four**

IL09	An Experimental and Modeling Study of Efficiency for a 253nm Xenon Iodide Lamp Excited by Dielectric Barrier Discharge <i>R.J. Carman, B.K. Ward, R.P. Mildren and D.M. Kane</i>	271
IL10	Development of Highly Efficient Mercury-free Flat Fluorescent Lamp (MFFL) for the Backlighting System of Liquid Crystal Display <i>K.W. Whang, J.K. Lee, J.C. Jung, I.W. Seo, B.J. Oh and J.K. Kim</i>	281
LL12	Modeling of glow like discharge in DBD Xe excimer lamp <i>H. Akashi, A. Oda and Y. Sakai</i>	285
LL13	Radial Segregation and Helical Instabilities in Metal Halide HID Lamps Studied under Microgravity Conditions in the International Space Station <i>T. Nimalasuriya, M. Haverlag, R. Keijser, A. Kuipers, W.W. Stoffels, J.J.A.M. van der Mullen and G.M.W. Kroesen</i>	287
LL14	The Calculation of Thermochemical Data for Light Source Modelling: Methods and Examples <i>G. Siddons, V. Ramos, S.A. Mucklejohn, J.C. Camacho, R. Devonshire and H. Davies</i>	289
LL15	Digital control for improved UHP lamp performance <i>D.H.J. van Casteren and R.L. Tousain</i>	291
LL16	Pulsed Xenon Discharge Lamps <i>U. Chittka, S. Gruhlke, S. Schwan, M. Sorokin and J. Vorachen</i>	293
CP088	Tomographic reconstruction of the spatial profiles of emitting mercury atoms in the vertically and horizontally operating capillary discharge lamp <i>N. Denisova, Z. Gavare, G. Revalde and A. Skudra</i>	295
CP089	Influence of the pulsed-current power supply on the 254 nm radiation flux emitted by a germicidal ultra-violet lamp <i>B. Mrabet, A. Chammam, H. Elloumi, M. Stambouli and G. Zissis</i>	297
CP090	Spectra of rare-earth iodide-cesium iodide systems in low-wattage metal halide lamps <i>T.R. Brumleve, K. Voggenauer, M.E. Lovell, T.E. Scott, D.B. DeHaven, D. Gordon, R.L. Steward and S.C. Hansen</i>	299
CP091	An Electrodeless HID Sulfur Lamp System Using a Nonrotating Bulb Excited by Circularly Polarized Microwave Discharges <i>J.J. Kim, K.S. Kim, K.S. Oh, D.H. Won and H.S. Yoon</i>	301
CP092	X-ray absorption tomography of a high-pressure metal-halide lamp with a bended arc due to Lorentz-forces <i>N. Denisova, M. Haverlag, E.J. Ridderhof, T. Nimalasuriya and J.J.A.M. van der Mullen</i>	303

CP093	Excitation temperature measure in a microwave induced Ar-Hg plasma <i>Y. Chen and D. Chen</i>	305
CP094	Simulating the Absorption of the Objects inside the Integrating Sphere for Measuring LED's Luminous Flux <i>X.L. Zhou, W.Y. Li, Y. Qian and M.Q. Liu</i>	307
CP095	Optimal current regulation strategy used for white LED in illumination applications <i>W. Yan and J.M. Zhou</i>	309
CP096	Barrier discharge excilamps steady state formation <i>M.I. Lomaev, V.F. Tarasenko and D.V. Schitz</i>	311
CP097	Investigation of antenna excited high-pressure microwave discharge lamp <i>M. Kando, T. Fukaya and Y. Ohishi</i>	313
CP098	Improvement of VUV efficiency in Low pressure Xe discharge by N <sub>2</sub> mixing <i>K.W. Park, H.S. Hwang, M.H. Han and T.I. Lee</i>	315
CP099	Realization of N-doped P-type ZnO Thin Films in the Mixture of N <sub>2</sub> and O <sub>2</sub> by RF Magnetron Sputtering <i>H.J. Jin, S.H. Oh, S.J. So and C.B. Park</i>	317
CP100	Suppression of Devitrification Using Chlorine Containing Silica Glass <i>N. Horii, M. Kamide, A. Inouye and N. Kuzuu</i>	319
CP101	Propagation of ionization waves in Compact Fluorescent Lamps <i>R. Langer, R. Garner, A. Hilscher, S. Horn and R. Tidecks</i>	321
CP102	Influence of power balance and radiation transport on temperature distributions of HID discharges <i>B. Schalk, G. Hartel, M. Käning and L. Hitzschke</i>	323
CP103	First steps of white LEDs in the General Lighting Market <i>X. Zhang, Y. Li, D. Janssen and G. van Tartwijk</i>	325
CP104	A study of a high pressure mercury lamp during the warm-up phase <i>Z. Araoud, R. Ben Ahmed, S. Kaziz, K. Charrada and G. Zissis</i>	327
CP105	Double Envelope Effect of Electrodeless Bulb for Microwave Sulfur Lamp <i>B.J. Park</i>	329
CP106	Evaluation of Plant Growth Lamps and its Application Prospect in China <i>Y.D. Lin, J.Q. Ju, W.H. Shi and C.X. Bu</i>	331
CP107	Model of hot cathodes for fluorescent lamps <i>D. Buso, G. Zissis and S. Bhosle</i>	333
CP108	Development of mercury free electrode less UV light for water purification <i>B.K. Pramanik, K. Yanai and A. Hatta</i>	335
CP109	End Darkening of MP Mercury Arc Lamps and Its Effect on Water Disinfection <i>G. Fang, J. Houghton, D. Olson and W. Verhulst</i>	337
CP110	Electrokinetic characteristics of the Hg-Ar discharge in super narrow tubes <i>M.A. Malkov</i>	339
CP111	Alternative approach to mercury-free HID lamps <i>St. Franke, H. Hess, R. Methling, H. Schneidenbach, H. Schöpp, L. Hitzschke, M. Käning and B. Schalk</i>	341

CP112	Evaluation of the discharge parameters in dimming process of an electrodeless fluorescent lamp <i>W. Li , Y. Liu, Y. Chen, D. Chen</i>	343
CP113	Method for Determining the Hg Content in Fluorescent Lamps <i>P. Essers, Z.H. Weng and Z. Yang</i>	345
CP114	Effect of Al addition on the structural and optical properties of alkaline earth halophosphate phosphors <i>S. Tanimizu</i>	347

## Session Five

IL11	Mercury-Free Light Sources: Xenon FL and Molecular Radiators <i>M. Jinno and H. Motomura</i>	351
IL12	Low-mercury containing discharge lamps. Sustainable and environmental friendly lighting solutions. <i>I. Snijkers-Hendrickx, P. Lauwerijssen, P. Milewski and V. Bruyndoncx</i>	361
LL17	Dimming and standardization <i>A. Hilscher</i>	371
LL18	Re-examination on Energy Saving & Environmental Issues in Lighting Applications <i>S.Y.R. Hui and W. Yan</i>	373
LL19	A Theoretical / Modelling Interpretation of Physical Property and Multiple Species Distributions Measured in an Operating Halogen Lamp <i>J.C. Camacho, G. Siddons, R. Bruckshaw, A. Keer-Rendon and R. Devonshire</i>	375
LL20	Novel Reduced EMI Compact RF Fluorescent Lamp <i>V. Godyak, B. Alexandrovich, A. Sapozhnikov and R. Speer</i>	377
CP115	Photoelectric work function measurement of an electrode in a low pressure Hg discharge lamp <i>H. Kozakura, S. Gotoh, T. Kasuya and M. Wada</i>	379
CP116	Experiments on the emission spectra of various gas filled lamps by means of TESLA High Frequency Tester <i>P. Kovács, A. Böröczki and G. Hárs</i>	PIC
CP117	Error analysis on Color measurement of LEDs by Spectrophotometer <i>M. Yi, A.M. Ge, C. Yuan and M.Q. Liu</i>	383
CP118	Measurement of breakdown voltage of lamp by different electrode materials <i>M. Goto, K. Fukushima, T. Uehara and T. Arai</i>	385
CP119	HF operated high pressure sodium lamps with optimized arc length <i>J. Hendricx and C. Stuer</i>	387
CP120	Acoustic Resonances in HID Lamps – Automated Measuring Station <i>B. Siessegger, K. Guenther, H. Gueldner and G. Hirschmann</i>	389
CP121	3D dysprosium density in the metal-halide lamp measured by emission and laser absorption spectroscopy in a centrifuge at 1-10 g <i>A.J. Flikweert, T. Nimalasuriya, G.M. Thubé, G.M.W. Kroesen and W.W. Stoffels</i>	391

CP122	Optical study of breakdown phenomenology in HID lamps <i>F. Manders, P. Aben and M. Haverlag</i>	393
CP123	A Study on Ultrathin Diameter Fluorescent Lamps at High Frequency Performance <i>Z.L. Chen and X.X. Li</i>	395
CP124	Influence of heating process on phosphor efficacy for mercury free lamp <i>T. Beaudette, P. Guillot and B. Caillier</i>	397
CP125	Reflector optimisation for low wattage metal halide lamps <i>G. Van De Poel, R. Geens and L. Derhaeg</i>	399
CP126	Novel plasma diagnostic system applicable for RF light sources <i>I.J. Choi and C.W. Chung</i>	401
CP127	Improvement of the luminous run-up characteristics in ballast-integrated compact fluorescent lamps covered with outer globes <i>T. Yasuda and M. Kando</i>	403
CP128	Self-reversed line estimates of Hg <sup>2+</sup> absorption in ultra-high pressure mercury lamps <i>D.O. Wharmby</i>	405
CP129	Small Signal Modelling of DC Super High Performance (SHP) Lamp <i>W.Q. Zhang, Y.Q. Jin and J.P. Ying</i>	407
CP130	Radial segregation in metal halide lamps; a critical analysis of the validity of the LTE approach <i>M.L. Beks, T. Nimalasuriya and J.J.A.M. van der Mullen</i>	409
CP131	Criterion for the uniformity of atmospheric pressure glow discharge <i>Y. Zhang, X.Z. Deng, S.L. Zhu and S.D. Zhang</i>	411
CP132	Standby mode study of dimmable electronic ballast in a street lighting application <i>R. Ruscassié, G. Beaufils and C. Glaize</i>	413
CP133	A characteristic shortening of a positive column during continuous operation of a low pressure Hg discharge lamp <i>S. Gotoh, S. Nishiuchi, T. Kasuya and M. Wada</i>	415
CP134	Manufacture the Induction Fluorescent Lamp <i>Y. Chen, D. Chen and W. Li</i>	417
CP135	Study of HID lamp by a 3-D and time-dependent model: determination of temporal distributions of electrode temperatures <i>K. C. Paul, T. Takemura, T. Hiramoto and T. Igarashi</i>	419
CP136	Species in the Arc Centre of an Operating Metal Halide Lamp: A Coherent Raman Scattering and Modelling Study <i>D.S. Payne, G.J. Wilson, S.A. Mucklejohn, G. Siddons and R. Devonshire</i>	421
CP137	Investigations on low-pressure indium mono-halide discharges <i>R. Hilbig, A. Koerber, D. Hayashi, S. Schwan and R. Scholl</i>	423
CP138	AC electrode diagnostics in HID lamps <i>H.A. van Esveld, G.M.J.F. Luijks, S. Nijdam and P.A.M. Weerdestein</i>	425
CP139	Analysis of Horizontal Distribution in the Xe based ICP for Lighting source <i>I.S. Her, J.C. Lee and D.H. Park</i>	427

CP140	Amalgam used to control the mercury-vapor pressure in a steady state <i>Z.M. He</i>	429
CP141	In-situ Temperature Measurement for Ceramic HID Lamps <i>W.P. Lapatovich</i>	431
CP142	High performance CO-Xe microwave discharge for VUV emission <i>J.S. Oh, K. Yanai, K. Kawamura, and A. Hatta</i>	433
CP143	Multi-function of a Novel Ignitor for HID Lamps <i>G.X. Zheng and X.J. Xu</i>	435
CP144	Development of 360 watts high-efficiency ceramic metal halide lamp <i>A. Maehara, T. Shimomura and H. Hayakawa</i>	437
CP145	UHP for fiber optic applications with high demands on colour rendering <i>P. Pekarski and U. Weichmann</i>	439
CP146	Temperature control of the electrodes in metal halide lamps by superimposed current operation <i>Y. Takahara and M. Kamata</i>	441
CP147	Study of tubular high power compound quartz-envelope xenon flashlamp <i>J.J. Liu, B.C. Jiang, H.B. Li, J.H. Yu</i>	443
CP148	Reaction times under mesopic conditions <i>P. Raynham, M.H. Girach, S.A. Mucklejohn and B. Preston</i>	445

## **Session Six**

IL13	Dimming Fluorescent Systems Life Experiment <i>M. Duffy, R. Erhardt, P. Hakkarainen, R. Hunt, T. Leyh, R. Nachtrieb, C. O'Rourke, T. Poehlman, R. Runkles and H. Wolfman</i>	449
IL14	Measuring color quality of light sources <i>W. Davis and Y. Ohno</i>	459
LL21	The ignition characteristic of an electrodeless induction lamp <i>Q. Long, Y.M. Chen and D.H. Chen</i>	469
LL22	Considerations and dominant interactions between low pressure fluorescent lamp and electronic ballast in dimming mode <i>M. Mayrhofer and S. Zudrell-Koch</i>	471

## **Session Seven**

IL15	Worldwide National Solid State Lighting Programs and Standardization Efforts. An Overview From Industry's Perspective <i>H. Nikol, D. Work, F. Tang, C. Hoelen and G. Heusler</i>	475
IL16	National SSL Program in CHINA <i>L. Wu</i>	479
LL23	With ThinGaN to 1000lm white ..... <i>V. Härtle, B. Hahn and J. Baur</i>	P 1C
LL24	High stable color tunable LED standard source <i>H.P. Shen, J.G. Pan and H.J. Feng</i>	489

LL25	White light-emitting diodes using (oxy)nitride phosphors <i>R.J. Xie and N. Hirosaki</i>	491
LL26	A New LED Light Source For Projection Applications <i>G. Kuhn, S. Zhou, N. Breidenassel and W. Schnabel</i>	493
CP149	Interpretation of the external band technique for cathode fall measurements of fluorescent lamps <i>R. Garner</i>	495
CP150	Simulating metal halide lamps under varying accelerational conditions with Plasimo <i>M.L. Beks, A.J. Flikweert, A. Hartgers and J.J.A.M. van der Mullen</i>	497
CP151	Homogenisation of a pulsed dielectric barrier Xe discharge using falling voltage edge for secondary ignition <i>M. Paravia, K. E. Trampert and W. Heering</i>	499
CP152	Measurement of antenna temperature and lamp properties in antenna-excited high-pressure metal halide microwave discharge lamp <i>M. Shido, T. Serita and M. Kando</i>	501
CP153	Proposal for Self-ballasted CFL lamp End of Life Safety Test Simulation <i>J. Bian and L.Y. Shi</i>	503
CP154	A study on Reliability Characteristics of Electrode-less Fluorescent lamp <i>J.C. Lee, Y.W. Kim, M.K. Hwang and S.Y. Yang</i>	505
CP155	Xenon Excimer Lamps Used for Degradation of Toxic Gaseous Carbon Disulfide <i>S.L. Zhu and X.F. Feng</i>	507
CP156	Arc Attachment to HID Lamp Electrodes under HF Operation <i>J. Reinelt, O. Langenscheidt, J. Mentel and P. Awakowicz</i>	509
CP157	High efficient & homogeneous emissive BLU simulated by thin-lens method <i>H.R. Lee, K.J. Hwang, S.J. Lee, Y.C. Yim and Y.K. Kim</i>	511
CP158	Spectroscopy of cesium pulsed high pressure discharge <i>G. Pichler</i>	513
CP159	Light-generating efficiency of external electrode fluorescent lamps (EEFLs) for the backlight applications of liquid crystal display <i>J.Y. Choi, Y.Y. Kim and J.H. Ko</i>	515
CP160	Measurement and research for standard LED <i>X.J. Song, R.L. Xu and Y. Chen</i>	517
CP161	Energy transfer enabled photoluminescence from Eu <sup>3+</sup> - and Er <sup>3+</sup> -doped TiO <sub>2</sub> semiconductor nanocrystals synthesized by RF thermal plasma <i>J.G. Li, M. Ikeda and T. Ishigaki</i>	519
CP162	Kinetic model of the gas discharge in a PDP-cell <i>V.V. Danilova and Ye.V. Martysh</i>	521
CP163	Sodium loss processes in the ceramic wall of High Intensity Discharge lamp arc tubes <i>H. Lovas, Z. Tóth, V.K. Josepovits and M. Tóth</i>	523
CP164	New High Temperature Amalgam and Hg dispenser for T5 Lamps <i>A. Corazza, C. Boffito, S. Frenzel and R. Hoffmann</i>	525

CP165	Estimation of Solarisation in Glass in Fluorescent Lamp <i>J. Abe and T. Akai</i>	527
CP166	Electrode Behavior in XenEco D4 Hg-free Automotive Headlight Lamps <i>L. Dabringhausen, U. Hechtfischer, T. Vos, W. van Erk and M. Haacke</i>	529
CP167	VUV radiation from xenon excimer in He-Xe dielectric barrier discharge excited by piezoelectric transformer <i>D. Inada, K. Teranishi, S. Suzuki, and H. Itoh</i>	531
CP168	Nb HT 1600, a new developed Nb alloy, to be used as construction wire in discharge lamps <i>B. Spaniol</i>	533
CP169	Optical characteristics of Xe:Ne mixture for electrodeless ICP lamp <i>S.J. Lee , G.S. Choi , J.K. Yang , S.M. Lee , N.G. Kim , Y.C. Yim, J.C. Lee and D.H. Park</i>	535
CP170	A Thermal Model of an High Pressure Mercury Discharge Lamp <i>J.C. Camacho, G. Siddons, M. Kai and R. Devonshire</i>	537
CP171	Cathode and anode research <i>M.S. Benilov</i>	539
CP172	UV light source of water vapor discharge excited by microwave <i>K. Kawamura, K. Yanai, B.K. Pramanik, J.S. Oh and A. Hatta</i>	541
CP173	Comparison of metal halide lamp performance on electronic versus magnetic ballasts <i>A. Lamouri, A. Naruka and J. Sulcs</i>	543
CP174	The structure of vapor complexes in metal halide discharge lamps <i>G.N. Papatheodorou and A.G. Kalampounias</i>	545
CP175	Flat rare gas - iodine excimer lamp driven by surface barrier discharge <i>M.M. Guivan, P. St'ahel, A. Brablec, J. Janca, H. Motomura and M. Jinno</i>	547
CP176	Parametric study of the performance of Hg free fluorescent signs <i>S. Point, E. Robert, S. Dozias, C. Cachoncinlle, R. Villadrosa and J-M. Pouvesle</i>	549
CP177	High Frequency Efficacy of Metal Halide Lamps <i>V. Roberts</i>	551
CP178	A new thermionic cathode based on carbon nanotubes with a thin layer of low work function barium strontium oxide surface coating <i>F. Jin, Y. Liu, S. Little and C.M. Day</i>	553
CP179	The development of high power discharge produced plasma EUV sources for next generation of the semiconductor chip manufacturing <i>V. Borisov, A. Eltsov, A. Ivanov, Yu. Kiryukhin, O. Khristoforov, V. Mishhenko, A. Prokofiev and A. Vinokhodov</i>	555
CP180	About colour rendition and light sources, the balance between simplicity and accuracy <i>P.J.M. van der Burgt and J.T.C. van Kemenade</i>	557
CP181	Dysprosium Oxide Ceramic Arc Tube for HID Lamps <i>G.C. Wei, W.P. Lapatovich and J. Browne</i>	559

CP182	The optical characteristics of the pulse-modulated Hg-Ar discharge <i>V.P. Kalanov and M.A. Malkov</i>	561
-------	---	-----

## Session Eight

IL17	Organic Light-Emitting Devices for Lighting Applications <i>J. Kido</i>	565
IL18	Recent progress and future prospect in white LED lighting technologies for general illumination <i>T. Taguchi</i>	567
IL19	Progress in high-power light-emitting diodes for solid-state lighting <i>M. Krames</i>	571
LL27	Present Status of the Efficacy and Light Quality of White LEDs: Potential for Energy Conservation and Environmental Preservation <i>S. Hosokawa, T. Sakamoto, S. Takashima, Y. Murazaki and H. Tamaki</i>	575
LL28	Total flux measurement of LEDs with a narrow beam luminous flux standard <i>M.Q. Liu, X.L. Zhou, W.Y. Li, C. Yuan and W.L. Zhang</i>	577
CP183	Transient spots on thermionic arc cathodes II. Experiment and comparison <i>P.G.C. Almeida, M.S. Benilov and M.D. Cunha</i>	579
CP184	Dependence of low watt metal halide lamp parameters on supply wave shape and frequency <i>B. Vanbrabant and R. Geens</i>	581
CP185	Radiation spectra of microcavity as a light source for incandescent lamp <i>H. Kamata and H. Ohkawa</i>	583
CP186	First experiments with net electrodes in high voltage fluorescent tubes <i>W. Lehmann</i>	585
CP187	Characteristic analysis of Blue-LED <i>H.C. Yen, G.R. Wang, S. Z. Wei and H. X. Chen</i>	587
CP188	Electrode heat-up in HID-lamps - model and experiment <i>A. Kloss and B. Schalk</i>	589
CP189	The measurement of temporal spectrum for HID lamps <i>J.D. Yu, T.S. Mou and J.P. Wang</i>	591
CP190	Comparison on operating characteristics of metal halide lamps with different ballasts <i>S.Y. Tang and C.S. Moo</i>	593
CP191	High intensity VUV spontaneous light source based on plasma emission of nanosecond high current inert gases discharge <i>M.I. Lomaev, D.V. Rybka, E.H. Bakht and V.F. Tarasenko</i>	595
CP192	Simplex optimization of metal halide lamp dose composition <i>T.R. Brumleve, D.L. Miller, K. Voggenauer, M.E. Lovell, T.E. Scott, D.B. DeHaven, D. Gordon, R.L. Steward and S.C. Hansen</i>	597
CP193	Spatially and Spectrally Resolved Emission from Compact High Pressure Xenon Lamps <i>D. Doughty, O. Minayeva, and S. Yeralan</i>	599

CP194	Pressure threshold for uniform air glow discharge <i>X.Z. Deng, Y. Zhang, S.L. Zhu and S.D. Zhang</i>	601
CP195	The candidness of CRI and CCT in describing the light quality of light sources <i>A.M. Dugar</i>	603
CP196	Luminance Characteristics of Planar Type Surface Wave Plasma Microwave Fluorescent Lamp <i>A. Nazri, A. Kondo, T. Takeda, H. Motomura and M. Jinno</i>	605
CP197	TiO <sub>2</sub> coating on metal halide discharge lamp arc tubes by charged liquid spray <i>J. Gao and D.B. DeHaven</i>	607
CP198	Quality assurance of light-emitting diodes <i>M. Bürmens, F. Pernuš and B. Likar</i>	609
CP199	Fluorescent lighting fixtures without flicker and EMI <i>D.Y. Fang</i>	611
CP200	Waveform analysis of HID lamps using driving signal with “resting period” <i>P. Kovács , A. Böröczki and G. Hárás</i>	613
CP201	Mercury plasma sources for Hg atomic analyser <i>E. Bogans , G. Revalde , A. Skudra , S. Sholupov and A. Svagere</i>	615
CP202	Plasma Analysis of Bulbous Electrodeless Fluorescent Lamps by Finite Element Method <i>A. Sato, A. Yonemaru, H. Fukunaga and H. Kakehashi</i>	617
CP203	Profiling the starting transient of metal halide lamps <i>S.Y. Tang, C.S. Moo, C.R. Lee and J.H. Chen</i>	619
CP204	Development of a high-color-rendering white LED lighting system for Japanese antique art <i>K. Kobashi and T. Taguchi</i>	621
CP205	Ujoy lamp for personal projection <i>H. Moench, U. Mackens, P. Pekarski, A. Ritz, G. S'Heeren and W. Verbeek</i>	623
CP206	Transient State Mercury Transport during the Run-Up phase of Inductively Coupled Fluorescent Lamps <i>R. Speer, P. Moskowitz and J. Holt</i>	625
<b>Author Index</b>		627