The 7th EU-Japan Joint Symposium on Plasma Processing

23rd to 26th April 2009

Château Liblice, Liblice, Czech Republic

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Programme

Thursday 23rd April 2009

	Registration	
19:00 -	*Dinner/Buffet*	

Friday 24th April 2009

	Talks to be held in the conference hall	
09:00 - 09:10	Opening	Nigel Mason (Open University)
	Session 1 Chair: Nigel Mason	
09:10 - 10:00	Is the plasma state important in surface plasma interactions?".	Dan Schram (Eindhoven)
10:00 - 10:30	Atmospheric Pressure Plasmas and Their Biological Applications	Satoshi Hamaguchi, (Osaka University)
10:30 - 11:00	*Coffee break*	
	Session 2 Chair: Satoshi Hamaguchi	
11:00 - 11:30	Exploring the chemistry that underpins growth of diamond by microwave plasma enhanced chemical vapour deposition	Michael Ashfold (University of Bristol)
11:30 - 12:00	Simulation of microwave plasma CVD for synthesis of large-size diamond crystals	Hideaki Yamada (Diamond Research Center of AIST)
12:00 - 12:30	Deposition profile control of carbon films in trenches using a plasma CVD method	Kazunori Koga (Kyushu University)
12:30 - 14:00	*Lunch Break*	

Friday 24th April 2009 *continued*

	Session 3 Chair: Mark Bowden	
14:00 - 14:30	Liquid Related Discharge and Electrolyte Plasmas for Creation of Bio-Nano Composite Materials	Toshiro Kaneko (Tohoku University)
14:30 - 15:00	Sub-microsecond pulsed discharges in and in contact with water	Peter Bruggeman (University of Ghent)
15:00 - 15:30	Atomic, molecular and optical data requirements for plasma processing	N J Mason (Open University)
15:30 - 16:00	*Coffee break*	
	Session 4 Chair: Dan Schram *Talks to be held in the Marble Hall*	
16:00 - 16:30	Modeling of post-discharge plasmas for medical sterilization: effect of the wall material on the species density distributions in a large volume reactor	Kinga Kutasi (Budapest)
16:30 - 17:00	Modelling plasma surface interactions	Erik Neyts (University of Antwerp)
17:00 - 17:30	Numerical simulations of microplasma formation in consideration of gas heating and gas flow	Satoshi Uchida (Tokyo Metropolitan University)
19:00 -	*Dinner*	

Saturday 25th April 2009

	Session 5 Chair: Zoran Petrovic *Talks to be held in the conference hall*	
09:00 - 09:30	The effect of an atmospheric pressure plasma jet on DNA	Mark Bowden (The Open University)
09:30 - 10:00	Emerging electric-acoustic metrology for industrial and research atmospheric pressure plasma	V Law (Dublin City University)
10:00 - 10:30	Mass spectrometry for atmospheric plasmas.	Yolanda Gonzalvo
10:30 - 11:00	*Coffee break*	
	Session 6 Chair: Petr Carsky	
11:00 - 11:30	Dipole alignment and device fabrication	David Field (University of Aarhus)
11:30 - 12:00	Modeling of Fast Neutral Transport in Low Pressure Discharges	Zoran Petrovic (Institute of Physics, Belgrade)
12:00 - 12:30	Plasma-surface interactions in the context of ITER	Juergen Rapp (FOM Instituut for Plasmafysica Rijnhuizen)
12:30 - 14:00	*Lunch Break*	
14:00 -	*Trip to Melnik: wine tasting & dinner in Melnik Castle*	

Sunday 26th April 2009

	Session 7 Chair: *Talks to be held in the conference hall*	
09:00 - 09:30	Deposition of microcrystalline silicon films by magnetron sputtering: deposition mechanism explored with laser-aided diagnostics	Koichi Sasaki (Nagoya University)
09:30 - 10:00	Measurements of the ion flux to the substrate in low-pressure plasma deposition systems	Petr Virostko (Charles University)
10:00 - 10:30	Laser Thomson Scattering and Optical Emission Spectroscopy for Low Temperature Recombining Plasmas	Shinichiro Kado (University of Tokyo)
10:30 - 11:00	*Coffee, Tea*	
	Session 8 Chair:	
11:00 - 11:30	Plasma interactions with catalytic surfaces	Christopher Whitehead (University of Manchester)
11:30 - 12:00	Independent Control of Ion Energy and Flux in CCPs by the Electrical Asymmetry Effect	Uwe Czarnetzki (Ruhr Bochum)
12:00 - 12:30	Dynamics of radio-frequency driven atmospheric pressure plasmas jets	Tim Gans (Queens University Belfast)
12:30 - 14:00	*Lunch*	
14:00 -	*Departure for Prague (buses will be arranged)*	

Investigation on atmospheric technological plasma and wood surface interactions by XPS analysis

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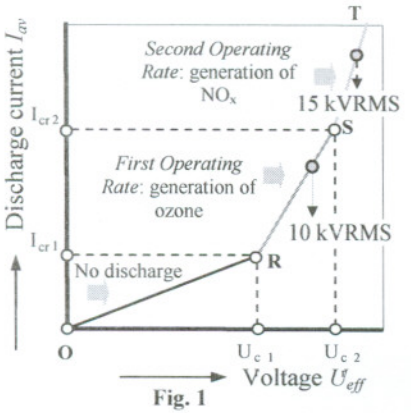

Fig. 1

Wood inactivation is a surface phenomenon affecting just a thin outer layer of wood. An inactivated wood surface does not absorb capillary well an impregnating solution containing phosphorous compound as flame retardant. Plasma-chemical surface activation (functionalization) with a effective participation of ionic surfactants and silicone spreaders eliminates the inactivation-impregnating problem creating a protective flame retardant layer.

The technological plasma produced by dielectric barrier discharge (BDB) at atmospheric pressure and room temperature has different chemical interaction with the wood surface according to the existence of ozone and exited oxygen, or nitrogen oxide (NO_x), containing plasma. Controlling the voltage – 10 or 15 kV RMS (50 Hz), it is probably to have different chemically functionalized wood surface and corresponding capillarity and impregnation activity fig. 1.

X-ray photoelectron spectroscopy (XPS), also referred to as electron spectroscopy for chemical analysis (ESCA), is a very powerful non-destructive surface analytical technique which provides valuable data on chemical surface composition and surface reorganization after plasma-chemical pre-treatment. The binding energy is a characteristic of the atoms, which can be used for elemental identification. For example, carbon bond to itself and/or hydrogen only has binding energy of 285.0 eV. The interpretation of the curve fit of the C1s peak after *Kazayawoko* (1998) was used to interpret the wood surface plasma chemistry, Table 1. A graphical illustration of the C1s peaks of the bare Douglas fir sample (BDf), and plasma treated (PT) in different rate (DBD at 10 and 15 kV, 50 Hz) Douglas fir samples is giving in the fig. 2.

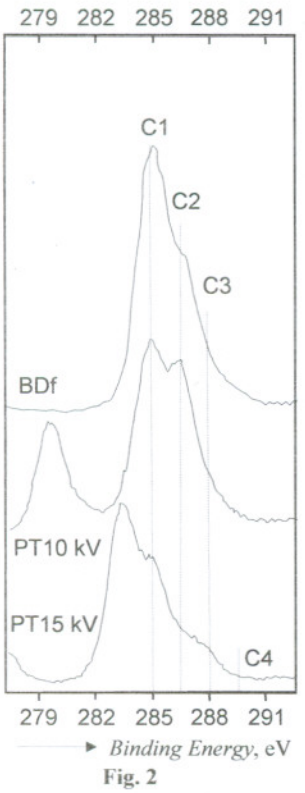

Fig. 2

The *BDf* sample has C1(285.0 eV); C2 (286.8 eV) and C3 (288.7 eV); the *PT-10 kV* sample - C1(284.9 eV); C2 (286.6 eV) and C3 (288.3 eV) plus two new peaks – one before C1 (279.7 eV) and one between C2 and C3 (287.5 eV); and the *PT-15 kV* sample - C1(285.0 eV); C2 (286.6 eV), C3 (288.0 eV) and contrary of expectation C4 (289.4 eV).

The theoretical C1/C2 ratio is increased in following order: pure cellulose - ≈ 0; lignin - ≈ 1; extractive and resin – up to 10. And the *BDf* sample has C1/C2 ratio - 2.065; the *PT-10 kV* sample - 1.615, and the *PT-15 kV* sample - 2.464. A high C1/C2 ratio reflects a high concentration of extractive and possibly lignin on the wood surface. The results showed that these experimental observations on affected surface chemistry distinguish clearly the different rate of plasma treatment – at 10 and 15 kV. The lignin is relatively immobile, but the extractives migrate easy to the wood surface after heat treatment.

Table 1. Typical value of binding energy

Carbon peak C1s			
C1	C2	C3	C4
Binding Energy, eV			
285.0±0,4	286.5±0,4	288.0±0,4	289.5±0,4
Kind of Corresponding Chemical Bond			
C-C	C-O	C=O	O-C=O
C-H	C-OH	O-C-O	
	H-C-OH		

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