5th International Conference on

PLASMA CHEMISTRY AND PLASMA PROCESSING

November 13-14, 2017 Paris, France

Scientific Tracks & Abstracts

Day 1






Major Sessions:

Plasma Chemistry | Plasma Classification | Plasma Diagnostics | Plasma Spectrochemistry | PlasmaNanotechnologies

Session Chair
Andre Ricard
University of Toulouse, France

Session Introduction

Title: **Densities of active species in N2 RF and HF afterglows**
Andre Ricard, University of Toulouse, France

Title: **Revealing structures and embedded interfaces with pulsed RF GDOES**
Patrick Chapon, Horiba, France

Title: **Dielectric barrier discharge plasma surface modification of polymers**
Lalita Ledwani, Manipal University, India

Title: **Cross-sections and dissociation rate constants for rare gas ions colliding with their parent gas in cold plasma jet for biomedical applications**
Benhenni Malika, University of Toulouse, France

Title: **RF inductive antenna probe for plasma process monitoring**
A A Howling, Swiss Plasma Center, Switzerland

Title: **Polyester powder coating of wood and wood composites with atmospheric pressure plasma jet (AAPJ)**
Robert Kohler, University in Göttingen, Germany

Densities of active species in N_2 RF and HF afterglows

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N_2 flowing afterglow emissions have been analyzed by optical emission spectroscopy in tubes of 21 and 18 mm internal diameter connected to RF and HF sources available in Suwon and Toulouse, respectively. The N_2 1st pos (580 nm), 2nd pos (316 nm) and N_2+ 1st neg (391.4 nm) band system intensities were recorded across the tube diameters from the pink (early) to the late afterglows at pressure 6-8 Torr, total flow rate 0.5-0.6 slm and input power of 100 watt. After calibration of the N atom density by NO titration, the concentrations of N-atoms, O-atoms coming from gas impurities, N_2(X, v>13), N_2(A) metastable molecules and N_2+ ions were determined in N_2 afterglows. It is found that N–atom density nearly constant from the pink to the late afterglow. For similar afterglow times, active species densities are higher in HF than in RF: 2 and 0.4x10^{15} cm-^{3}, respectively. Anatase nanocrystals and ALD (Atomic Layer Deposition) TiO_2 samples were exposed to the RF and HF afterglows at room temperature. XPS analysis of samples submitted to the RF afterglow has shown that the best N/Ti coverage: 0.24 was obtained in the N_2 late afterglow where the N atoms are the most populated active species. In the HF late afterglow, the N/Ti coverage was limited to 0.04 in spite of higher N-atom density: (1-2)x10^{15} cm-^{3}. Such results are explained by higher O-atom impurity in HF: 2x10^{13} cm-^{3} in comparison to 8x10^{11} cm-^{3} in RF. Then, the N/O ratios in the RF and HF afterglows were respectively (0.5-1)x102 and 5x102 with the same variations as found for the N/Ti coverages.

Biography

A Ricard worked at Ecole Polytechnique as a physicist from (1960-1962). Then form 1962-1964 he worked at Institut Optique as Engineer, from 1964-1967 worked at Sud-Aviation as Engineer, from 1967- 2007 he worked as a researcher in CNRS. He received his PhD in 1971 form University of Toulouse. He is expertise in the field of plasma spectroscopy, kinetics of plasma excited species, applications to surface treatments.

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Patrick Chapon et al., J Biot Phyt 2017

Revealing structures and embedded interfaces with pulsed RF GDOES

Patrick Chapon and **Sofia Gaiaschi**
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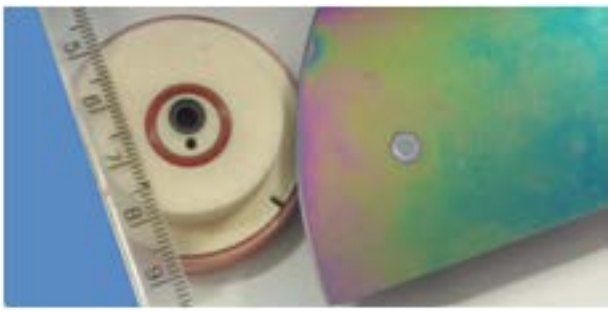
Pulsed RF GDOES is a fast elemental depth profile technique capable to measure all elements (including H, D, O, C etc) with easy sample mounting (Image 1). With the recent introduction of DIP – an online differential interferometer - it also allows to accurately measure erosion rates and layer thickness with nanometric precision. The specificities of the GD plasma (high density, low average energy of the sputtering particles) make it in addition a very interesting tool to reveal structures for SEM observation and EBSD measurements. Some examples will be shown on flat surfaces and on cross sections. Changing the plasma gas from the classical Ar to a gas mixing with O addition offers Ultra-Fast Sputtering (UFS) of polymeric layers with excellent depth resolution and permits to access to embedded interfaces below organic coatings. The mechanisms of sputtering with "UFS" will be discussed and multiple applications ranging from PV to packaging or Li batteries will be presented.



Biography

Patrick Chapon is working as products Manager at Horiba Company, France. He started his employment duration 20 yrs at Longjumeau, France. He received his graduation form IFP graduate engineering school in the field of laser.

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Dielectric barrier discharge plasma surface modification of polymers

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With increase of industrialization, demand for all polymeric materials for various applications in fastest growing field. At a time increase in environmental concern needs to develop environmental friendly processing of these polymers. Non-thermal plasma is an emerging eco-technology for surface modification which can advantageously improve dyeing of various natural and synthetic materials. Dielectric barrier discharge (DBD) plasma treatment of polymers has attracted great interest due to low cost, high processing speed, reduced environmental impacts and simple system of operation. The advantage of DBD over other discharges lies in having the option to work with non-thermal plasma at atmospheric pressure and a comparatively straightforward scale-up to large dimensions. In the present study, two different types of polymers: Polyester and leather polymers were exposed to dielectric barrier discharge at atmospheric pressure in oxygen and air plasma. DBD plasma treatment changes surface morphology and chemical composition of polyester and leather polymers. Surface analysis was carried out using with various characterization techniques such as ATR-FTIR spectroscopy, X-ray photoelectron spectroscopy (XPS), Scanning electron microscopy (SEM) for both the polymers. We observed significant improvement in hydrophilic properties after oxygen and air plasma treatment. Apparent decrease in contact angle in plasma treated polymers is attributed to functional group formation and roughness which is created by DBD plasma treatment. Aging effect on plasma treated polymer surfaces was also studied. Dyeing of untreated and plasma treated polyester textile has been carried out using six natural dyes by alcohol assisted dyeing method at room temperature. Spectroscopic measurement and fastness analysis have shown significant increase in colour intensity and dye uptake properties on plasma treated samples. This study divulges that DBD plasma treatment is dry and eco-friendly technique to modify the polymer surface to improve dye uptake properties with natural dyes at room temperature.

Biography

Lalita Ledwani is a professor in the department of chemistry at Manipal University Jaipur; served as head of chemistry department from year 2011-2014, and she is the controller of examinations in the same University. She has been extensively working in plasma surface modification of polymers and natural products research areas. She has received external research grant from different funding agencies namely KWEF, Japan, DST, Govt of India, DST, Govt of Rajasthan and UGC, Govt of India. On her credit, she has more than twenty research papers published in peer reviewed international and national journals, she also delivered several invited/expert lectures besides more than forty research papers in international and national conferences. She has supervised three PhD theses and three PG dissertations and four UG dissertations. At present, six research scholars and one post doc fellow are working under her supervision. She has also organized various national and international academic events as a convener/coordinator.

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Cross-sections and dissociation rate constants for rare gas ions colliding with their parent gas in cold plasma jet for biomedical applications

Benhenni Malika and **Kalus Rene**
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Momentum transfer cross-sections for the non-dissociative ion scattering and collision-induced dissociation is calculated for different rare gas dimer cations (He_2+, Ar_2+, and Ne_2+) in a collision with their respective parent gas. Different methods (quantum, hybrid, and inverse) have been used for momentum transfer cross-section in the ion collision energy range (0.01 - 100) eV. While a full quantum treatment is used in the quantum case, the hybrid dynamical method uses a classical treatment for nuclei and quantum treatment for electrons where the electronic Hamiltonian is calculated via a DIM semi-empirical model. On the other hand, the inverse method, based on a simple isotropic potential and JWKB semiclassical approximation, uses measured ion mobility to extract ion momentum transfer collision cross-sections. These calculated cross sections are used in an optimized Monte Carlo code that simulates the ion trajectory to obtain He_2 +, Ar_2 + and Ne_2 + reaction rates and transport coefficients over a wide reduced electric field range. The obtained dissociation reaction rate data are compared to measurements when available (for Ne_2 + dissociation only) in the literature. These calculated dimer cation dissociation rate constants are necessary as input data in electrohydrodynamic and chemical plasma models of the low-temperature plasma jets to quantify and optimize the production of active species for biomedical applications.

Biography

Benhenni Malika obtained her PhD in atomic physics from University of North Carolina at Chapel Hill, USA, in 1990 and concerns the electron capture and excitation processes by auger electron spectroscopy for hot plasma applications. She was a research assistant in Laboratoire Grenoblois des Ions, plasmas et physique atomique in 1991. She is an associate professor at University of Toulouse III- Paul Sabatier in France. Her current research is carried out in Laboratoire Plasmas et Conversion d'Energie and focuses on modelling of basic data for cold plasma applications such as biomedicine, flue gas pollution control, etc. She is referee in several international journals.

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RF inductive antenna probe for plasma process monitoring

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Monitoring of plasma parameters such as the electron density is crucial for advanced process control. A non-intrusive inductive probe is described which is sensitive to the plasma via their mutual inductance. The resulting change in impedance of the antenna probe causes a shift in its resonant frequency which is tracked by a phase-locked loop. The antenna is modelled as a multi-conductor transmission line, where the mutual inductance depends on its complex image in the plasma. We describe the design of a prototype, its calibration by 100 GHz heterodyne microwave interferometry, and preliminary measurements of plasma density.

Biography

A A Howling obtained his master's degree in science and application of electric plasmas at Oxford University in 1982, followed by PhD at Culham Laboratory, UKAEA. In 1989, he co-founded the industrial plasma applications group with Dr. Ch Hollenstein at the Swiss Plasma Center in EPFL Lausanne. He is currently working as a Senior Scientist in the group of Dr. Ivo Furno for basic plasma physics and applications at EPFL, Switzerland.

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Polyester powder coating of wood and wood composites with atmospheric pressure plasma jet (AAPJ)

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[2]University of Gottingen, Germany
[3]Fraunhofer Institute for Surface Engineering and Thin Films, Germany

Introduction: Powder coating processes represent an alternative to conventional coating methods. Especially, the possibility of total omission of all kinds of additives comprising volatile organic compounds or organic solvents renders this process environmentally friendly. Furthermore, it omits the need for special substrate properties such as electrical conductivity. The electrical conductivity is particularly important for standard powder coating processes, as the powder adheres to the substrate due to different electric potential, is applied to the powder-substrate-system. To charge a powder, commonly a corona discharge is used and the powder is sprayed onto the grounded substrate. In case of wood and wood composites, the limited electrical conductivity constitutes a disadvantage. To coat a non-conductive and porous substrate like the beforehand mentioned ones a pre-heating or priming process using an electrically conductive wet lacquer is usually necessary.

Materials & Methods: In this study, an APPJ has used to applicate a polyester powder (Interpon 610 MZ013GF; D50 ≈ 50 µm) (Akzo Nobel Powder Coatings GmbH, Arnsberg, Germany) to wooden and wood-like substrates. The powder material is based on iso- and terephthalic acid and was deposited using the effluent plasma zone of the source in use. The coating substrates are European beech wood (Fagus sylvatica L.), Grand fir (Abies grandis lindl) and medium density fiberboard (MDF). After the plasma treatment, the coating was annealed in an oven at 180°C for 10 min. The coated samples were examined via X-ray photoelectron spectroscopy (XPS) and Fourier-transform infrared spectroscopy (FTIR) to determine possible chemical decomposition of the applied polyester during the plasma coating process. In addition, the resulting layer thicknesses of the samples were determined using laser scanning microscopy (LSM). Adhesive strength investigations were carried out using dolly test based on ASTM D 4541-02 and DIN EN ISO 4624:2016-08

Results: The applied powder material exhibited no chemical changes due to plasma process and the adhesive strength of the layers met practical requirements of >1 MPa. The presented atmospheric pressure plasma coating process for wood and wood-based materials could represent an interesting alternative to existing wood coating methods.

Biography

Robert Köhler is pursuing his PhD at University in Göttingen. His thesis is concerned with "The weathering resistance and the catalytic degradation of VOC`s of plasma particle-modified wood and wood materials". Currently, he is a research scientist at the project "PLaNaWood2- functionalization of wood and wood materials" with financial support from the German Federal Ministry of education and research. He has published one poster presentation and one patent.

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Notes:

Major Sessions:

Plasma Medicine and Plasma Biology | Plasma Processing | Applied Plasma Technologies | Areas of Plasma Technology | Chemistry of Plasma with Liquids

Session Chair
Florent Lemont
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Session Introduction

Title: **Adaptation of plasma technologies for hazardous and nuclear waste processing**
Florent Lemont, French Atomic Energy Commission, France

Title: **Cold atmospheric pressure plasma (CAP): Effect on human lice and applicability for pediculosis treatment**
Lars ten Bosch, HAWK University of Applied Sciences and Arts, Germany

Title: **Head and neck cancer treatment with plasma activated medium**
Merbahi Nofel, LAPLACE - University of Toulouse, France

Title: **Inductively coupled thermal plasma – A versatile tool for the pro-cessing of powders**
Marc Leparoux, EMPA - Swiss Federal Laboratories for Materials Science and Technology, Switzerland

Title: **The decomposition mechanisms of SF6 and its candidate C5F10O**
Xiaohua Wang, Xi'an Jiaotong University, China

Adaptation of plasma technologies for hazardous and nuclear waste processing

Florent Lemont, P Charvin, M Marchand, S François, A Russello, K Poizot and **R Magnin**
French Atomic Energy Commission (CEA), France

The CEA develops for several years different kind of process in order to treat nuclear wastes. It has appeared that some of them could be used to destroy other industrial hazardous wastes such as organo-halogenated liquids or others, largely used as precursor in chemical industry. These processes have the particularity to involved plasma tools in order to reach very high temperature level leading to get very good destruction efficiencies. Thermal and UV photoactivity of the plasma can be simultaneously used to reach the best results. The present paper provides the description of three different thermal processes developed at the CEA to treat radioactive liquid waste: the SHIVA process using bipolar twin torches that involve transferred arc plasma. The IDOHL process involving inductive coupled plasma torch and the ELIPSE process working with an underwater blown arc plasma torch. An additional technology will be presented: The one using cold plasma as corona pulsed discharges in order to design very efficient and enduring filtering system. These systems are intrinsic and in dissociable of very safe and reliable processing. The studies performed on semi industrial or on industrial mockup provide very attractive results showing that these processes could be applied for different kind of waste, nuclear or not. Example of plasma application – The ELIPSE process (submerged plasma process for pure organic liquid treatment)

Biography

Florent Lemont is head of innovative processes laboratory, he has experience in processes and high temperature chemistry at French Atomic Energy Commission CEA. He worked as supervise research (HDR) in the year 2007 in the materials and process engineering department. He is the head of innovative processes laboratory – French Atomic Energy Commission. He is expert in the field of processes and high temperature chemistry. He is the teacher at the Engineering school of Albi, master of science of Pau, master of science of Marseille he is the member of "Program Advisory committee" of international conference on thermal treatment technologies and hazardous waste combustor, member of scientific committee of international conference on engineering for waste and biomass valorization, member of scientific committee of SFGP, scientific advisor CIRP (Taiyuan – Chine).

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Cold atmospheric pressure plasma (CAP): Effect on human lice and applicability for pediculosis treatment

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Every household can easily be struck by an infestation of head lice (Pediculus humanus capitis) regardless of its tidiness and personal hygiene. Especially, children and people spending a lot of time or are working in strongly populated environments are vulnerable to this infestation. When it comes to an infestation with head lice (Pedicuclus humanus capitis) most of the applied remedies available on the marked work with different insecticides such as lindane, malathion or permethrin. These are known to display toxic side and their provocation of resistances, as already build up by some populations. Results from different experiments concerned with possible and useful applications of CAP against pest insects led to the development of an alternative pediculosis treatment method based on the principle of a dielectric barrier discharge. This method can give non-toxic, insecticide-free and environmentally friendly alternative to existing pediculosis remedies. Based on a capacitively coupled setup, a comb-like electrode construction was chosen to ignite the plasma near to the scalp. To treat the complete volume of the hair, an electrode form was build that is not adapted to the heads contour, thus allowing the simultaneous treatment of scalp and hair in different distances from the scalp. We present the results of preliminary study conducted under controlled laboratory conditions. The presented experiments consider results of the treatment of adults, nymphs and eggs of Pediculus humanus bred by the German Environment Agency (Umweltbundesamt) in Berlin. The plasma comb was scoured through human hair strands infested with the lice stages at s/cm for one single transition. The treated lice were observed up to 48 h and eggs until 15 days after egg deposition. Furthermore, the efficacy was examined under ideal conditions by introducing single adult lice directly to the plasma exhibiting a mortality rate of 100% within 24 h. Observing the perishing process of the individuals under investigation it seems probable that the presumed mode of action is resulting mainly through presence of fast electric fields/dielectric heating.

Biography

Lars ten Bosch is pursuing his PhD at Clausthal University of Technology. His thesis is concerned with the possibilities that atmospheric pressure plasma is offering within the fields of plasma pest management and plasma agriculture, as well as plasma medicine. Currently, he is a project manager and research scientist for the main research: “Plasma based pest management in everyday life”. He has published one article, six poster presentations and two patents and has been serving as a reviewer for the American Chemical Society.

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Head and neck cancer treatment with plasma activated medium

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Biomedical applications of low-temperature plasmas are of growing interest. These plasmas jet are an interesting source of active species (charged particles, radicals, long-lived excited species, UV photons, electric field, etc.) that can easily be launched on any prokaryote or eukaryote cells, living tissues, biomaterial surfaces. The present work is aimed at investigating the regionalized antiproliferative effects plasma activated medium (PAM) on multicellular tumor spheroid (MCTS), a model that mimics the 3D organization and the regionalization of a microtumor region. A homemade helium plasma jet was used to produce PAM. In the case of multicellular tumor spheroids, results indicate that PAM can induce cell detachment in the first day in a PAM time-dependent manner associated with the regionalized accumulation of DNA damage detected by histone H2AX phosphorylation. This DNA damage is due to the presence of hydrogen peroxide in PAM. However, a cellular protective response that defends FaDu cells against H2O2 is observed and a rapid spheroids regrowth is occurring. After multiple PAM treatments of FaDu, MCTS growth inhibition is obtained. Finally, this study underlines the importance of working with MCTS instead of 2D cells. Indeed, after PAM treatment, monolayer culture using a high number of cells has a response at day one close to the MCTS one. But in the following days, cells behaviors diverge. Contrary to MCTS that have a high proliferation rate at day two, cells in 2D culture continue to die. Observations on 2D cell culture can suggest that a single PAM treatment is enough to kill cancerous cells. Our results clearly demonstrate that MCTS models, closer to an *In vivo* tumor, displayed a defense response leading to a growth increase of spheroids which requires adaptation of treatment with PAM.

Biography

Merbahi N has completed his PhD from Paul Sabatier University, France. He is the professor in Toulouse University, France. He has over 60 publications that have been cited over 300 times, and his publication H-index is 15.

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Marc Leparoux, J Biot Phyt 2017

Inductively coupled thermal plasma - a versatile tool for the processing of powders

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Among the thermal plasmas, the inductively coupled ones present the advantage of large vol-ume and moderate velocity making this technique well suitable for the controlled evaporation or melting of large quantities of particulate materials. Thus, ICP is industrially used for the synthesis of nanoparticles, or for the spheroidisation and densification of microscale powders. The nanoparticle synthesis involves the formation of a supersaturated phase and its subsequent rapid condensation. A high flexibility is provided by this technique regarding the feedstock. A most common production route is the evaporation of commercially available and easy to handle microscale particles, but liquid and even gases can also be used as starting materials. The control of the thermal history of these precursors is of prime importance for guaranteeing the quality of the product. Indeed, strong temperature gradients in the plasma may lead to different evaporation rates, particle sizes or even different compositions. An *in-situ* diagnostic is then required for understanding and controlling the process. Due to the dusty and high-temperature environment, optical techniques are an interesting approach giving valuable information about the plasma state, the particle-plasma interaction and even about some na-noparticle properties. Additionally, the injection of a secondary material allows the function-alization of the produced nanoparticles in-situ and in-flight offer new potentials for ICP pro-cessing. More recently the fast growing of additive manufacturing induced a specific interest in powder spheroidisation for making powders more flowable. Indeed, in the powder bed ap-proach, a powder layer is deposited before the laser or the electron beam is writing a structure. A defect in the powder layer arrangement may induce a defect in the additive manufactured the part. Therefore, highly flowable powders are required. By adapting the inductive plasma process parameters, a full melting of the starting powder without extensive evaporation can be achieved. The melt particles form then dense spheres with improved flowability upon cooling. Empa is investigating thermal plasmas and especially ICP since more than 15 years. A short review of the activities will be presented here.

Biography

Marc Leparoux is head of the group of nanoparticles and nanocomposites at the laboratory for advanced materials processing at Empa. He received his Magistère in materials science and a DEA in solid chemistry in 1992 at University of Rennes. He completed his PhD in physical chemistry in 1995 from University of Orléans in France. He then worked on high temperature process monitoring at Fraunhofer institute for material and beam technology (IWS) in Dresden, Germany. He joined Empa in 2001 where he developed the activities on thermal plasma synthesis of nanoparticles. Particularly, his interest is in gas phase process un-derstanding and improvement based on *in-situ* characterization using various optical methods, among them emission and absorption spectroscopy as well as high speed imaging. These techniques are presently also used in other plasma induced processes as for instance in laser metal welding and more recently in laser metal deposition an additive manufacturing process.

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Notes:

The decomposition mechanisms of SF_6 and its candidate $C_5F_{10}O$

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The decomposition mechanisms of SF_6 with impurities (moisture and trace oxygen) and one of its candidates-$C_5F_{10}O$, were thoroughly studied in this paper. The quantum chemistry methods were adopted to investigate the decomposition processes of SF_6 and $C_5F_{10}O$. We also calculated the rate constants of the chemistry reactions included in above processes over a large temperature range from 300 K to 12,000 K. The dominant reactions and species in the decomposition were finally determined. The decomposition mechanisms of SF_6 are hoping to lay a theoretical basis for service life condition online-monitoring of power equipment by analyzing SF_6 decomposition components. And the results of $C_5F_{10}O$ play an important role in the feasibility study on alternative gas for SF_6 and can be used to further investigate the corresponding eco-friendly switchgear in the future.

Biography

Xiaohua Wang received his BSc degree from Chang'an University, Xi'an, China in 2000 and PhD degree from School of Electrical Engineering of Xi'an Jiaotong University, China, in 2006. His research interests are mainly in plasma chemistry, design and fault diagnosis technologies of electrical apparatus. He has published more than 100 peer-reviewed papers. He is an awardee of supporting program of new century excellent talents in University of the Ministry of Education.

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Notes:

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Scientific Tracks & Abstracts

Day 2






Major Sessions:

Plasma Chemistry | Plasma Classification | Plasma Diagnostics | Plasma Spectrochemistry | Applied Plasma Technologies | Areas of Plasma Technology | Plasma Medicine and Plasma Biology

Session Chair

Daniel Fruchart
Institute of Neel, France

Session Introduction

Title: **Structure and thermodynamics of Mg-Ti-H films deposited by microwave plasma-assisted co-sputtering**

Daniel Fruchart, Neel Institute – CNRS, France

Title: **Efficient degradation of organic dyestuffs wastewater by liquid phase plasma synergy with nano-material photo catalysis**

Wanyuan Gui, University of Science and Technology, China

Title: **The experimental study on the plasma gasification and vitrification of fly ash and bottom ash**

Ming Hu, Everbright Envirotech, China

Title: **A single electrode plasma discharge tube device**

Shouguo Wang, Qilu University of Technology, China

Title: **Transient model of the metallic plasma and neutral gas interaction in a low-pressure arc**

D F Devia, National University of Colombia, USA

Structure and thermodynamics of Mg-Ti-H films deposited by microwave plasma-assisted co-sputtering

Daniel Fruchart
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Introduction: Hydrogen storage ennobles renewable and intermittent energy objectives thanks to electrolysis from wind-mill and PV. MgH_2 is performing since Mg abundance, low cost, 7.6 w% H-storage capacities. However, sorption kinetics remain slow, unless adding specific additives in dedicated nanostructures. Early transition metals, not forming stable compounds with Mg can act as efficient catalyst. Thin films deposited by co-sputtering Mg and Ti were hydrogenated/dehydrogenated revealing original nanostructures, mechanisms of reaction, but some metastability of h-Mg-Ti alloy.

Methods: We operate direct combinations of Mg, Ti and H in a single-step process, using the microwave reactive plasma-assisted co-sputtering technique. Mg-Ti-H films with Ti contents $0 \leq$ at. %Ti < 20 were investigated by XRD, SEM, TEM-EDX for morphology, crystal structure, composition and distribution of elements. Ti-poor films (at. %Ti≤0.45) exhibit the β–MgH2 phase mainly, with a dense microstructure and discontinuous columnar grains. Films with intermediate Ti-contents (2.7≤at. %Ti≤6.6) exhibit β–MgH_2, metastable γ–MgH_2 and h-Mg-Ti phases in different proportions, with well-developed columnar grains. Films with Ti-contents >10 at. % form fine grain amorphous/Nano-crystalline structures.

Results: Ti content reveals critical in tuning the functional properties of magnesium hydride. The structure and morphology of different films were investigated after dehydrogenation comparison made with initial hydrogenated states using XRD and SEM. The thermal stability was studied by TGA and DTA coupled with mass spectrometry.

Conclusion: In comparison with monohydrides MgH_2- and TiH_2-films, lowest desorption temperatures of Mg-Ti-H films were observed for ~4.8 at. %Ti. The as-deposited h-Mg-Ti phase appears stable upon hydrogenation/dehydrogenation delivering comprehensive approaches on easier Mg $\leftrightarrow MgH_2$ reactions.

Biography

Daniel Fruchart has completed his MSc in mathematics at Lille University and; completed hab.D physics from Joseph Fourier University, Grenoble. He has worked as the Director 1 at CNRS from the year 1995-2009 and he took the responsibility of research group at Institute Neel (1982-2009) for 8-12 Staffs, 2 post docs, 10 PhD students, 1 Engineer. He is the founder and Research manager to MCMF department at Neel Institute since 2008 to 2013. He has published more than 820 reviewed papers and has 16 book contributions with H factor 42, RS citations more than 8800.His interests include magnetic materials, metal-hydrides, synthesis/metallurgy, thin films, neutron scattering, x-ray spectroscopy and group theory.

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Notes:

Efficient degradation of organic dyestuffs wastewater by liquid phase plasma synergy with nano-material photo catalysis

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Clean water is a prerequisite not only for human life but also for all life on the planet. But the aquatic ecosystem is severely affected by industrialization, notably industry dyestuffs wastewater, due to its unique features, such as composition complicated, high density and toxicity, and difficult to bio-chemical degradation. In the past several decades, numerous efforts based on advanced oxidation processes(AOPs)have been made to remediation these wastewaters, such as photocatalytic oxidation, ozone oxidation, wet oxidation, non-thermal plasma processing. Among those AOPs, non-thermal plasma can achieve greater output and better efficiency, due to the discharge processes where a lot of high energy electrons and active radicals and molecules are generated, which can effectively have degraded of dissolved organic compound molecules. However, fast and efficient degradation of organic wastewater in few minutes is still facing substantial challenges, and it's the main technical barriers that impede its commercialization. Here, an innovative method for rapid degradation of organic wastewater by electrolytic plasma processing synergy with four photocatalysis of nano-material: Au@SiO_2, TiO_2, NiO, and ZnO with 2g of $K_2S_2O_8$ addition. The results showed that 50 mg of RhB dyestuffs fully degraded in less than 10 minutes were observed by UV and fluorescence. The mechanism behind these effects were investigated in detail, and it's mainly attributed to the two reasons: A large number of free electrons and high-energy active substances were produced under the environmental of electrolytic plasma processing, as a result of free radical chain quickly reacts in the system; on the other hand, sulfate radical (E°=2.7-3.1 EV) with extremely strong standard electrode potential was introduced into system, and it can efficient degradation of the vast majority of dissolved organic matter. In addition, sulfate radical has a wide range of pH value applicable range: at pH 2.0-7.0, and the sulfate radical in the water can exist in a relatively stable state; when the pH is higher than 8.0-10.0, hydroxyl free radicals is formed by the part of the sulfate radicals reacting with the water; when pH value of solution is higher than 10 most of the sulfate radical is transformed to hydroxyl free radicals, and the coexistence or shift of both radical can greatly enhance the oxidation capacity of the system. The organic dyestuffs wastewater can be efficiently degraded by the cooperation of those reactions, which provides a broad prospect for industrial wastewater treatment.

Biography

Wanyuan Gui received his doctorate in materials science and engineering, form State Key Laboratory for advanced metals and materials, University of Science and Technology Beijing, China. His research interest is towards liquid phase plasma engineering applications, such as surface modification, coating and wastewater treatment.

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Notes:

The experimental study on the plasma gasification and vitrification of fly ash and bottom ash

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Fly ash and bottom ash generated from hazardous waste incinerator still belong to hazardous waste, because they contain a lot of heavy metals and dioxins. At present, the main disposal method is landfill, although it has the disadvantages of taking up a lot of lands, producing serious secondary pollution and so on. Plasma gasification and vitrification are one of the cleanest and most efficient technologies to deal with solid waste, and it produces little pollution and can make maximum use of resources. In order to obtain key data for engineering application, fly ash and bottom ash were melted using a plasma furnace of the pilot scale with feeding and discharging continuously. The properties of vitrification, secondary fly ash, and gaseous product were analyzed thoroughly, and the net input power required was also calculated. As the results, the density of the vitrification was 2.8-3.5 g/cm^3 and the leaching results of heavy metals from the vitrification were below the limits (EN 12457/GB 5085.3). The plasma furnace could deal with 300 kg of fly ash and bottom slag continuously, and the net input power was 0.8 kWh/kg. The yield of the secondary fly ash was nearly 7%, and the main components of it were NaCl and KCl. However, there are several urgent problems to solve, such as reducing the energy consumption, extending the service life, dealing with the high content of chlorine and making up the most use of vitrification products.

Biography

Ming Hu obtained his PhD degree in plasma physics from University of Science and Technology of China, China in 2014. He has joined in Everbright Envirotech Ltd, Nanjing, China as a Director of research in 2015. Since 2015 he served as a head of the plasma technology working group at the Everbright Environmental Research Institute, Nanjing, China. He has published seven articles, one book chapter and 20 patents. His publications reflect his research interests and expertise in experimental study of thermal plasma, waste plasma gasification technology and ash plasma melting technology.

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Shouguo Wang, J Biot Phyt 2017

A single electrode plasma discharge tube device

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A discharge tube device has a replaceable discharge tube and a hand-held shell into which the replaceable discharge tube is plugged. There is a single electrode inside of the tube and no other electrodes outside. This electrode is connected to an output of a power supply and another output of the power supply is connected to the ground. The input of the power supply is a 12 V or lower, DC (direct current) source, or a battery. The plasma is generated via a contact-tube outside discharge, or a plasma jet from the tube, that uses working inert gas. The plasma discharge tube will produce atmospheric pressure, cold quasi-glow plasma, which can be used for sensitive surface disinfection, sterilization, as well as facial skin rejuvenation, treatment of skin tissue infections and destruction of cancer cells.

Biography

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Transient model of the metallic plasma and neutral gas interaction in a low-pressure arc

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A physical transient model and system of equations with spherical symmetry, was formulated to describe the interaction between metallic plasma ions with neutral gas, in the outer region of a multicathode spot vacuum arc operated with a background gas. The model considers the self-consistent processes for typical values of arc parameters, including the electron and ion drift velocities, the electron and neutral gas temperatures, and the electrostatic potential profiles are obtained from the border of the arc channel up to the discharge chamber wall. It is studied that values of arc parameters strongly influences the metallic plasma density and plasma potential distributions.

Biography

D F Devia did his under graduation form university National University of Colombia-Manizales in implementation and automation of technical variables of an industrial reactor used in the production of coatings by pulsed arc. He has completed his masters in model of an AC / DC three - phase converted for analysis of harmonic distortion. He received his PhD in kinetic modelling of plasmas produced in cathode arcs in vacuum for applications in the processing of materials from National University of Colombia.

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