International Low Temperature Plasma Community

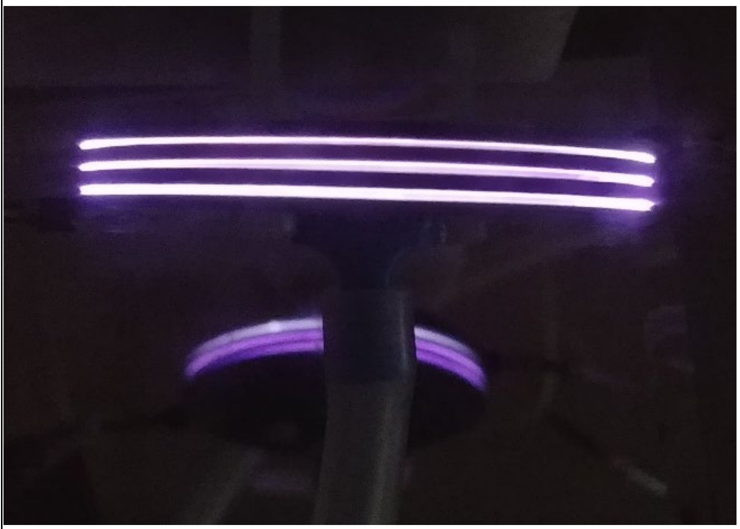
https://mipse.umich.edu/iltpc.php, iltpc-central@umich.edu

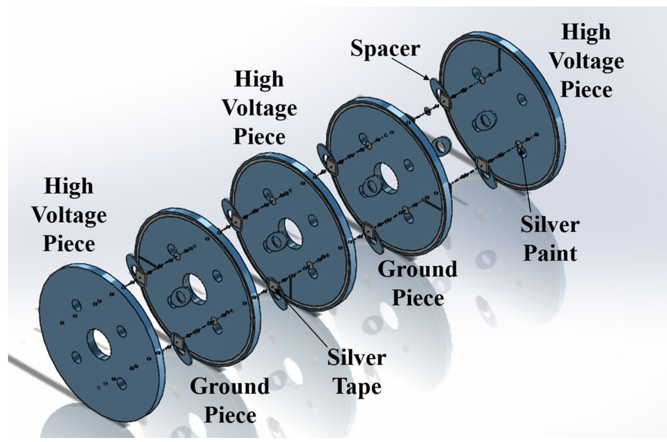
Newsletter 28

21 December 2022

Images to Excite and Inspire!

Please send your images (with a short description) to iltpc-central@umich.edu. The recommended image format is TIF, JPG, or PNG. The minimum file width is 800 px.





A cold atmospheric pressure plasma array in a radial configuration has been developed using Low Temperature Co-fired Ceramic (LTCC). The 4 cm diameter array consists of disks with a central gas manifold hole. The disks are stacked together with internal spaces to set the plasma discharge gap. Opposing silver paste circular electrodes buried under 115 µm of LTCC provide the AC voltage. These electrodes are placed roughly 1 mm from the outer edge of the disks. Silver paste filled vias provide the electrode connections with silver tape making the connection between each electrode element. Nylon bolts placed through 4 holes in the LTCC hold the structure together. Typical operating parameters are an AC voltage of 2 kV at 20 kHz with a 3-element array drawing ≈ 10 mA. In the image, the exploded view drawing show the disks with one piece connected to HV and the other connected to ground in an alternating configuration. The image shows the discharge for Ar gas. The top is the actual device and the bottom image is a mirror reflection. Such an array could be used for plasma treatment of cylindrical structures such as pipes.

Prof. Jim Browning, Boise State University, USA, Jimbrowning@boisestate.edu.

In this issue:	
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Call for Contributions

Please submit content for the next issue of the Newsletter. Please send your contributions to iltpc-central@umich.edu by **January 20, 2023.** Please send contributions as MS-Word files if possible – and **avoid sending contributions as PDF files**.

In particular, please send **Research Highlights and Breakthroughs** using this ***template:*** https://mipse.umich.edu/iltpc/highlight_template_v05.docx. The highlight consists of an image and up to 200 words of text; please also send your image as a separate file (the recommended image format is JPG or PNG; the minimum file width is 800 px). The topic can be anything you want - a recently published work, a new unpublished result, a proposed new area of research, company successes, anything LTP-related. Please see the *Research Highlights and Breakthroughs* for examples.

Plasmas, An Evolving Multidisciplinary Field – Yesterday, Today and Tomorrow

Ever since the discovery of the electrical discharge tube by William Crookes in 1875, and thereafter the coining of the word plasma by Irving Langmuir in 1928, the study of ionized gases have come a long way. James Van Allen's discovery of the radiation belts in 1958, opened up the field of space plasma physics, and the development of high power lasers in the 1960s led to the field of laser produced plasmas. Our relentless quest for fusion energy either through laser driven inertial confinement or Tokamaks, bears promise to remediate the energy crisis faced by mankind today, that is becoming unsustainable with purely fossil fuels. Plasma science and technology has therefore become a widely studied and researched subject, that has permeated many walks of our lives through its numerous applications.

The traditional low pressure DC discharges were employed in swarm studies to determine electron impact cross sections such as excitation and ionization, which has helped our understanding of various plasma processes. Hot-filament discharges helped investigate plasma confinement and phenomena in multi-dipole devices. From around the 1980s, we saw a proliferation of more advanced electromagnetic wave assisted plasmas, such as those created by RF and microwaves in the 13.56 MHz and 2.45 GHz frequencies respectively. The wave assisted sources became popular because of the possibility of creating high density plasmas. In this regard electron cyclotron resonance (ECR) and surface wave plasmas employing microwaves, and capacitively and the inductively coupled plasmas employing RF waves, revolutionized both basic and applied plasma research in many fields, such as generation of large area uniform plasmas for industry, thrusters for space propulsion using helicon plasmas, and basic studies on wave propagation and absorption. The UHF and VHF plasmas in the frequency range 50-800 MHz have also been considered favourable, as they provide commercially viable processing rates and substantial reduction in sheath voltages compared to RF plasmas.

While many fundamental advancements in plasma physics have come through the above studies of low pressure plasmas, there are limitations in terms of the ease of doing research due to plasma accessibility and economic aspects such as costs involved in vacuum and magnetic systems. It is largely with this view, that non-equilibrium, cold atmospheric pressure plasmas such as the plasma jets, and the more recent plasma in liquids, have become quite popular these days. The simplicity of their creation, novel surface interaction effects with possibility of applying them to cells and tissues, and the rich atmospheric chemistry, have made them attractive in a variety of applications such as biology, medicine, environment, agriculture, and material processing. Although atmospheric pressure plasma jets have a history of more than 50 years, however, from about 2005, the research has seen an exponential and rather unprecedented growth, as judged from the number of publications. While it is heartening to see this increased activity, we must continue fundamental investigations as well to relate process outcomes with intrinsic plasma phenomena, crucial to advance the field.

Prof. Sudeep Bhattacharjee
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Prof. Dr. Cristiane Yumi Koga-Ito – From Multispecies Oral Biofilms to Cold Atmospheric Plasma in Dentistry

Cristiane Y. Koga-Ito began her high education in Brazil as a student in the Faculty of Dentistry, São Paulo State University – UNESP, where she received her bachelor's degree in 1993. Then Cristiane continued her studies at the University of Campinas, Brazil, where she received her Master and PhD degrees in Oral and Dental Biology and Pathology in 1995 and 1997, respectively. From 1997 to 1999, Dr. Koga-Ito was a postdoc in Medical Mycology at the University of Turin, Italy. After that, she spent more two years as a postdoctoral researcher in Mycology and Molecular Biology at the Federal University of Minas Gerais, Brazil. In 2002, she was appointed assistant professor in the Faculty of Dentistry, São Paulo State University, bringing her back to UNESP. Since 2018, Dr. Koga-Ito is a full professor at the Institute of Science and Technology, UNESP, campus in São José dos Campos.

It should be also pointed out that Dr. Koga-Ito was a short-term visiting researcher at several prestigious institutions such as the Institute Malbrán, Buenos Aires, Argentina, in 2007; Faculty of Dentistry, University of Hong Kong, China, in 2010; Academic Center for Dentistry, Amsterdam, The Netherlands, in 2010; and Leibniz Institute for Plasma Science and Technology INP-Greifswald, Germany, in 2016.

Since the beginning of her studies Cristiane Koga-Ito has focused her research on understanding the fundamentals of oral biofilm formation and developing approaches for its mitigation. While in the early phase of her academic career Koga-Ito worked mostly with conventional (drugs related) methods for biofilms suppression, later she gradually shifted to field of biomedical applications of low-temperature plasmas. Over the past 10 years she has actively collaborated with the Faculty of Engineering and Science, UNESP in the field of cold atmospheric plasmas and their biomedical applications. She is currently coordinating a research project on the development and characterization of a cold atmospheric plasma source for dental applications, as well as the indirect use of plasma through plasma-activated liquids.

Dr. Koga-Ito has served as a board member of BMC Complementary Medicine and Therapies. Also, she has been part of the Editorial Advisory Board of Journal of Investigative and Clinical Dentistry, as well as the International Journal of Dentistry.

Over the years Prof. Cristiane Koga-Ito has advised 10 Master and 13 PhD students and supervised 4 postdoctoral fellows. Currently she supervises 5 PhD students, one master student and 3 post-docs.

In addition to her scientific and teaching activities, Prof. Koga-Ito has been involved in university administration and research management, as Advisor at the UNESP Office for Graduate Studies, and as Coordinator of Dentistry Area at the São Paulo Research Foundation – FAPESP. She is a leader of the Research Group called Alternative methods for the control of microorganisms at Brazilian National Council for Scientific and Technological Development – CNPq.

As one of her principal collaborators, I have admired her enthusiasm, insistence on the highest research quality and Cristiane's ability to coordinate big research projects, participate in scientific administration and lead a multidisciplinary research team all at the same time.

Prof. Konstantin Georgiev Kostov
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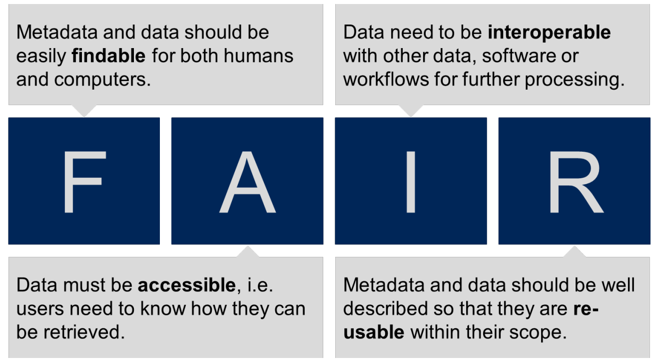
General Interest Announcements

- **2nd Workshop on FAIR Data in Plasma Science, May 3-4, 2023, Bochum, Germany**



We invite you to attend the **2nd Workshop on FAIR Data in Plasma Science** from May 3-4, 2023 at Ruhr University in Bochum (Germany). The workshop is organized by INP in Greifswald, Christian-Albrechts University in Kiel and Ruhr University in Bochum.

The workshop addresses researchers at different stages to exchange on the topic of data management. The topics of the workshop will be electronic lab notebooks, practical issues in the daily life with research data management systems as well as presentations of already established solutions. Moreover, an interactive part is planned to focus on how to get standards to the lab. Here, we would like to address all participants to bring in their ideas and expertise from the field.

The workshop will be held as a hybrid meeting. More information and a link for registration are available on the website: https://www.plasma-mds.org/ws-fair-data-plasma-science-2.html.

We kindly ask you to save the date and to spread this information to your colleagues and/or students who might be interested.

Contacts:
Dr. Markus Becker, Leibniz Inst. Plasma Science & Technol., Germany, markus.becker@inp-greifswald.de
Dr. Kerstin Sgonina, Christian-Albrechts-Universität Kiel, sgonina@physik.uni-kiel.de
Dr. Marina Prenzel, Ruhr-Universität Bochum, Germany, marina.prenzel@rub.de

Meetings and Online Seminars

- **The Online Low-Temperature Plasma (OLTP) Seminar Series**

The schedule for OLTP seminars and more information on the program, including links to past seminars, can be found at the OLTP website:

https://theory.pppl.gov/news/seminars.php?scid=17&n=oltp-seminar-series

The seminars are held on Tuesdays at 10:00 am EDT or EST via Zoom and are free to access from anywhere in the world.

Co-Chairs:

Dr. Mikhail Shneider, Princeton University, USA, shneyder@princeton.edu
Prof. Dr. Vasco Guerra, University of Lisboa, Portugal, vguerra@tecnico.ulisboa.pt

- **IOPS Online Seminars**

The *International Online Plasma Seminar (IOPS)* is continuing to provide the international community with regular opportunities to hear from leading researchers in the field. The program of the IOPS (and links to past seminars) can be found at: http://www.apsgec.org/main/iops.php.

Chair:
Prof. Quan-Zhi Zhang, Dalian University of Technology, China, qzzhang@dlut.edu.cn

- **Minicourse on "Plasma and Cancer" at IWPCT-8, Raleigh, North Carolina USA**

The *8th International Workshop on Plasma for Cancer Treatment*, which will be held in Raleigh, North Carolina, USA, March 14 & 15, 2023 will be preceded by a one-day minicourse, on Monday, March 13. The topics covered by the minicourse will be:

1. Plasma-induced cellular changes – cancer cells vs. normal cells
2. Redox biochemistry
3. Plasma treatment of cancers – ablation vs. immunotherapy
4. Plasma devices as a controllable source of RONS delivery for cancer treatment
5. Indirect plasma application
6. Lessons from clinical experience with treatment of precancerous lesions with plasma
7. Discussion: Plasma for oncotherapy – road to the clinic: direct Vs. indirect and local Vs. Systemic treatment

The lectures will be given by leaders in the field of plasma oncology. Students and researchers interested in these plasma applications are encouraged to register for the minicourse to learn both the fundamentals and the latest in the field. The registration fee is only $50, at any time before the start of the minicourse/workshop.

To register for the minicourse, please use the following link: https://www.iwpct2020.org/registration/.

Contacts:
Prof. Vandana Miller, Drexel University, USA, vam54@drexel.edu
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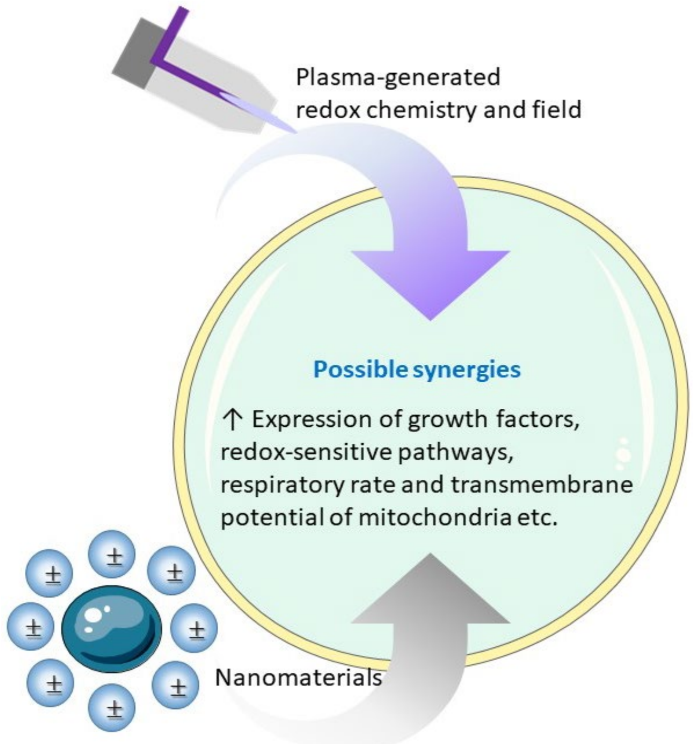
Prof. Annemie Bogaerts, University of Antwerp, Belgium, annemie.bogaerts@uantwerpen.be

Community Initiatives and Special Issues

Please submit your announcements for community initiatives and special issues to iltpc-central@umich.edu.

Possible Synergies of Nanomaterial-Assisted Tissue Regeneration in Plasma Medicine: Mechanisms and Safety Concerns



Plasma provides a promising tool for nanomaterial-assisted tissue regeneration in plasma medicine, for which multiple possible synergies are envisioned in this perspective article regarding the underlying biochemical and biophysical mechanisms.

To a great extent, cold atmospheric plasma (CAP) and nanomaterials have emerged independently with different time frames for similar applications in biomedicine. Their versatility is readily explained by their various functions, such as drug delivery, bioimaging, electrochemical sensing, oxidative stress regulation, nanocatalysis, and local electric or magnetic field modulation.

Most of the research has already been performed on the synergistic combination of nanomaterials and CAP in the context of cancer treatment. Less attention has been paid up to now to the synergy of CAP and nanomaterials in tissue engineering and regenerative medicine. Hence, many questions remain on the potential of this promising hybrid technology. Moreover, regenerative medicine relates to sterilization and plays a pivotal role in dermatology, wound healing, dentistry, and oncology. Because both CAP and nanomaterials fall into this category for a broad range of biological materials, their combination is especially promising as a post-treatment technique in oncology.

The long-term clinical effects of combined plasma treatment with nanomaterials are also largely unexplored. Unintended and hidden synergies need to be identified and profoundly understood, not only for a rapid but also for a safe advancement of the combined technology.

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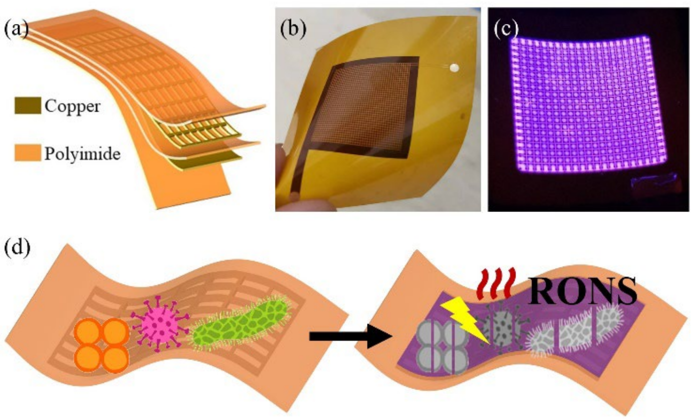
Source:
Shaw, P.; Vanraes, P.; Kumar, N.; Bogaerts, A. Nanomaterials **12**, 3397 (2022).
https://doi.org/10.3390/nano12193397

Flexible Plasma Film for in situ Inactivation of Bacteria and Viruses



(a) A schematic diagram of the structure of the flexible plasma film; photograph of the film **(b)** without discharge and **(c)** with discharge. **(d)** Schematic diagram of possible disinfection mechanism of flexible plasma film.

COVID-19 has caused harm to human life and health all over the world. Curved surfaces in public places may harbor SARS-CoV-2 virus and enable its transmission. Therefore, in situ real-time disinfection of these curved surfaces is very necessary.

A flexible plasma film based on a surface dielectric barrier discharge is proposed in this study. In situ disinfection and the influence of curvature on the performance of the device are studied. The results show that the film can, in situ, inactivate a variety of pathogens. Specifically, 10 min plasma treatment results in a log reduction of 3.10, 3.42, and 3.03 for *Escherichia coli*, *Staphylococcus aureus*, and vesicular stomatitis virus, respectively. The discharge power and disinfection of the film are independent of the curvature, which shows that it can be used for in situ disinfection of curved surfaces. It is speculated that the combined effects of a strong electric field and radical etching producing physical damage as well as chemical damage of reactive oxygen and nitrogen species to the protein are the main reasons for the inactivation of pathogens. The inhibition of the film to Omicron type SARS-CoV-2 pseudovirus is 99.3%, and the killing rate to natural bacteria is 94.3%. The film can run for at least 10 hours without significant reduction in disinfection effect. In addition, large-scale and digitalization increase the practical potential of this flexible disinfection film.

In conclusion, this plasma film is expected to realize in situ real-time disinfection of curved surfaces such as the buttons of the elevator or instrument and door handles, which is of great significance in blocking the spread of COVID-19.

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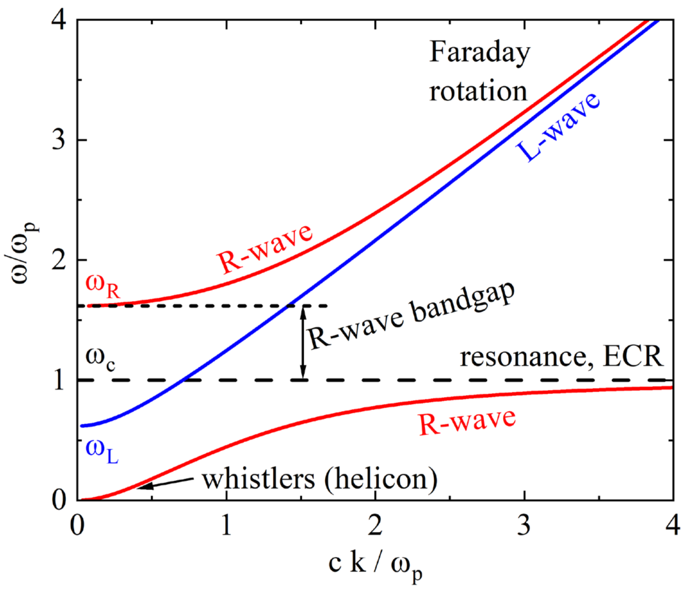
Source:
Yuntao Guo et al, Applied Physics Letters **121,** 074101 (2022). https://doi.org/10.1063/5.0100114

Foundations of (Magnetized) Radio-Frequency Discharges



Dispersion relation for the R- and L-waves for the case $\omega_c = \omega_p$. The cutoff and resonance frequencies are also indicated. The region of RF frequencies is usually below ω_L.

Radio-frequency-sustained discharges form an essential branch in low-temperature plasmas. They find a wide range of applications, owing to their characteristic properties, which arise due to the unique interactions of the oscillating electromagnetic field with the plasma particles. Power supplied by oscillating high-voltage sheaths or evanescent waves, collisional and collisionless heating are few prominent examples for these interactions. Adding a magnetic field introduces a whole new dimension of complexity and opportunities. Propagation of intrinsic wave modes, resonant energy absorption, plasma confinement and drifts determine the behavior of the discharge. All of these phenomena naturally offer a rich field for fundamental research and applications but unavoidably pose also a challenge for the newcomers in the field. In these two papers, the main relations and the defining characteristics of radio-frequency sustained discharges without and with applied external magnetic field are introduced and a wealth of literature sources is provided for further detailed reading. The papers are intended as an entry point for students and researchers eager to explore this fascinating field as well as a brief compendium for experts.

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Prof. Uwe Czarnetzki
Ruhr University, Bochum, Germany
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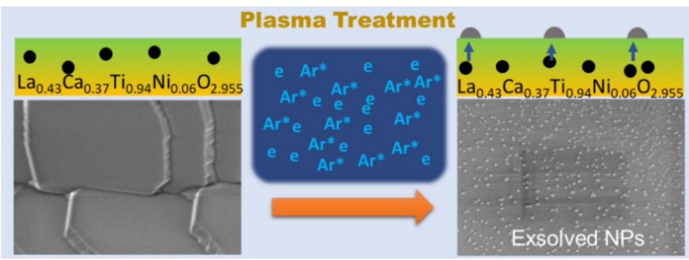
Sources:

Pascal Chabert, Tsanko V. Tsankov and Uwe Czarnetzki, Plasma Sources Sci. Technol., **30**, 024001 (2021). https://doi.org/10.1088/1361-6595/abc814

Tsanko V. Tsankov, Pascal Chabert and Uwe Czarnetzki, Plasma Sources Sci. Technol., **31**, 084007 (2022). https://doi.org/10.1088/1361-6595/ac869a

Rapid Plasma Exsolution from Perovskite Oxide at Room Temperature



Low temperature plasma treatment of perovskite oxide to socketed exsolve nanoparticles on the surface.

This featured research from *Advanced Energy Materials* discusses successful exsolution by a non-thermal plasma at low temperature for the first time.

Exsolution was observed on perovskite oxides where nanoparticles could be produced from transition metals present on the B-site of an ABO_3 perovskite oxide. Exsolution is initially determined by surface oxygen defects and provides a driving force for the transport of metal ions from the bulk to the surface. Conventional exsolution processes generally require strongly reducing conditions using H_2 at high temperatures (400-900 °C) and extended heating periods of several hours.

We observe exsolution within few minutes with an argon low-pressure, low-temperature plasma and achieve large particle densities. These results pave the way to new research directions to understand the fundamentals of direct plasma exsolution, exsolution with new materials and chemistries as well as new application avenues that have been limited thus far due to the requirement for high temperature processing.

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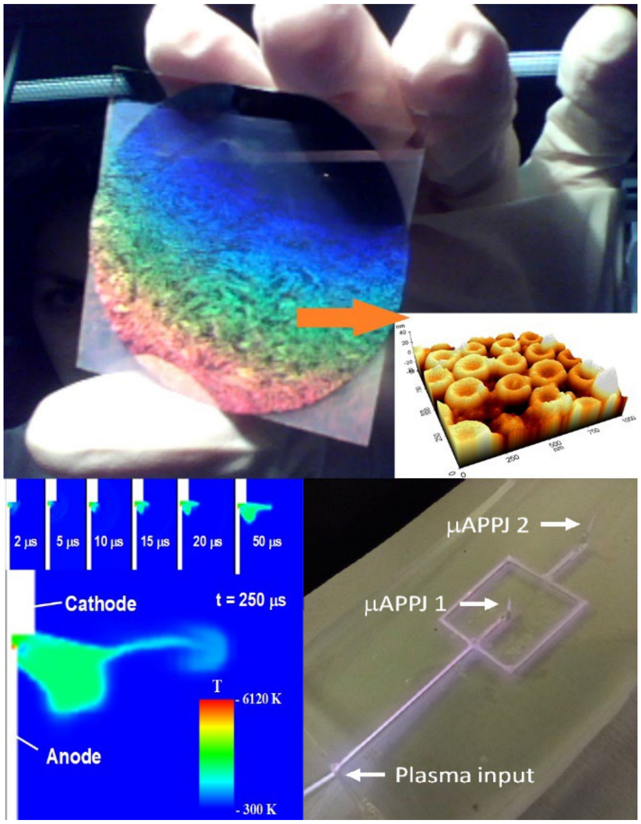
Source:
Rapid Plasma Exsolution from an A-site Deficient Perovskite Oxide at Room Temperature, Adv. Energy Mater. **12,** 2201131 (2022).
https://doi.org/10.1002/aenm.202201131

New Research Line at GW University Focused on Pulsed Plasmas and (Bio)Materials



Top: Silicon wafer surface textured by nanoparticle plasma lithography (Inset: AFM image of the sculpted nanopillars).

Bottom left: Fluid simulation of an arc discharge pulse in helium atmosphere computed by means of USim platform. Software developed by Dr. M.N. Kundrapu, Tech-X Corp.

Bottom right: Atmospheric pressure microplasma jets (µAPPJs) generated through microfluidic channels. Device fabricated in Prof. Z. Li's Lab, George Washington University.

"Coatings and Biomaterials meet Ionized Gases", with C-BIG as provisional acronym, is a new research line debuting at the School of Engineering and Applied Science of the George Washington University. The main goals are to understand and develop techniques using periodically variable plasmas to process any kind of materials.

A first project is devoted to implementing strongly ionized magnetron discharges on applications beyond deposition of protective coatings, such as selected-area functionalization on microstructured surfaces. An example of ionized physical vapor deposition technique is constituted by high-power pulsed magnetron sputtering. The second objective consists of modulating arc discharges to synthesize nanomaterials having tailored properties, like graphene and nanotubes. In this context, advanced plasma diagnostics will be crucial to monitor and control plasma parameters. Finally, the third part involves designing cold atmospheric plasma sources with environmental and healthcare applications in view. For instance, cold plasma jets with variable geometries are expected to pattern chemical maps on soft surfaces showing arbitrary topologies.

C-BIG aims at leveraging state-of-the-art resources and knowledge in vacuum and atmospheric pulsed plasma discharges to address cutting-edge topics in materials science and technology. Computer, mechanical, aerospace, and biomedical engineering will benefit from the outcome of this interdisciplinary line of work.

Contact:
Dr. Carles Corbella
George Washington University, USA
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More information:
https://www.seas.gwu.edu/c-big-could-make-big-impact-seas

New Resources

Please submit your announcement for New Resources to iltpc-central@umich.edu.

Career Opportunities
(for other career opportunities, see: https://mipse.umich.edu/jobs.php)

- **Post-doctoral Researcher, Development of an Atmospheric-pressure Plasma Source with a Tuneable Chemistry, York University, UK**

We are looking for a short-term (up to 6 months) postdoc researcher for a project on the development of an atmospheric-pressure plasma source with a tuneable chemistry. The focus of the advertised position is to continue our work on the (experimental) characterisation of the tuneable plasma chemistry using advanced optical and laser diagnostic techniques for low-temperature plasmas.

Role: You will be responsible for the operation of a pulsed atmospheric-pressure plasma with an advanced power supply capable of creating variable pulse shapes. You will characterise the chemistry of these tuneable plasmas using a suite of diagnostic techniques, including Two-Photon Absorption Laser Induced Fluorescence, Stark Spectroscopy, UV-Absorption Spectroscopy and Fourier-Transform Infrared Spectroscopy. The end goal is to be able to create a plasma source that can deliver a user-defined, on-demand plasma chemistry.

Expected skills:
- An undergraduate degree in relevant subject, e.g., Physics, Chemistry, Engineering, Electronics.
- A PhD degree in plasma science, ideally low-temperature plasma science.
- A background in diagnostics in (low-temperature) plasmas, ideally in atmospheric-pressure plasmas.
- Experience with any of the following plasma diagnostic techniques is desirable: Laser Induced Fluorescence, UV-Absorption Spectroscopy, Stark Spectroscopy and Fourier-Transform Infrared Spectroscopy.
- Highly developed communication skills evidenced by peer-reviewed journal publications and presentations at conferences.
- A collaborative ethos, with a willingness to work effectively with project partners.

For more information and for applications see: https://jobs.york.ac.uk/vacancy/postdoctoral-research-associate-lowtemperature-plasma-science-507227.html.

Closing date: **3 January 2023**.

Contact:
Dr. Erik Wagenaars
York University, UK
erik.wagenaars@york.ac.uk

- **Post-doctoral Researcher in Magnetized Laser Produced Plasma Experiments for Fusion, University of Alabama, Huntsville, Alabama, USA**

Applications are invited for a Post-doctoral Researcher position at the University of Alabama in Huntsville (UAH) starting at the earliest in January 2023.

Description: The Post-doctoral Researcher will be joining new collaborative project between UAH and Los Alamos National Laboratories (LANL) to study the interaction between a magnetized plasma target and a high velocity plasma jet to advance our understanding of the plasma-jet driven magneto-inertial fusion (PJMIF) concept. The project is funded for a 3-year duration. Periodic travel to LANL, a few weeks a year is expected to collaborate with LANL researchers on the Plasma Liner Experiment (PLX). The applicant may also participate in the NSF EPSCoR project in plasma science and engineering, FTPP (https://www.uah.edu/cpu2al). CPU2AL is a collaboration between nine Alabama universities and industry partners to conduct research in different areas of low-temperature plasma science and engineering from astrophysics to material science. Multi-disciplinary collaborations across campus are encouraged.

Qualifications and duties: Successful applicants will have a Ph.D. or equivalent qualifications in physics, engineering, or related fields. Demonstrated experience in experiment plasma research, especially lasers, optical diagnostics, vacuum systems, or pulsed power are highly desired. The researcher will have primary responsibility for the experimental portion of the project. This includes designing, setting up, and running experiments using a Nd:YAG laser to generate a plasma on a solid target in the vacuum chamber inside a pulsed magnetic field to create a magnetized plasma target. A high energy plasma jet created by a coaxial plasma gun will then discharge and collide with the magnetized target. The researcher will apply diagnostics to study the plasma behavior to understand the jet-target interaction. There is a computational component being carried out by a collaborator which the researcher will need to interact with and contribute to as needed. In addition to project duties, the researcher will be expected to work as part of a multidisciplinary team and prepare reports, presentations for conferences, and peer-reviewed journal papers. The researcher will also assist with proposal writing and student mentoring in relevant topics. Occasional travel (few weeks/year) to LANL will be required as part of the project to work with collaborators.

Applications from candidate who are nearing the completion of a relevant Ph.D. degree will be considered. Applications from female, minority, and underrepresented groups are strongly encouraged.

General inquiries and applications can be sent to **Dr. Gabe Xu** (gabe.xu@uah.edu). Applications should include a statement of interest and relevant experience, CV, and contact information for 2-3 professional references. References will only be contacted with prior approval of the applicant to maintain confidentiality.

Contact:
Prof. Gabe Xu
University of Alabama-Huntsville, USA
Gabe.Xu@uah.edu

- **Post-doctoral Researchers, Plasma Surface Interaction (Data and Tools) Coupled Modelling (PSI.COM), IPFN/IST, Lisbon, Portugal**

Project PSI.COM addresses the coupled modelling of the plasma-surface chemistry in N_2-H_2 mixtures, comprising several exciting endeavours: bridging the gap between volume and surface reactivity in plasma simulations; exploring the full potential of high-quality controlled measurements in an interplay with self-consistent time-dependent kinetic simulations; embracing screening/reduction of chemistry schemes as key-component of modelling; and publishing validated data in web-based platforms.

We will leverage on complementary expertise in modelling and diagnostics of low-temperature plasmas (LTP) from group N-PRiME (N-Plasmas Reactive: Modelling and Engineering, Instituto de Plasmas e Fusão Nuclear – IPFN, Instituto Superior Técnico – IST, Lisbon Portugal) and from LPP (Laboratoire de Physique des Plasmas, École Polytechnique, Palaiseau, France).

Project tasks involve:

(i) The study of N_2-H_2 plasmas and the catalytic production of ammonia, using an interplay between modelling and diagnostics to understand the volume + surface kinetic paths, and to validate and reduce the kinetic scheme.

(ii) The development and the consolidation of the LoKI tool suite, aiming at full time-dependent description, extended to surface reactions and including the gas/plasma thermal balance, and including ML tools for sensitivity analysis.

(iii) The formulation and implementation of solutions for data storage and parsing in LTPs modelling, aiming at developing a high-performance open-access data-storage library for LoKI, in association with the LXCat stakeholders.

PSI.COM is currently inviting expressions of interest (EoI) for:

- A three-year postdoctoral position at IPFN/IST, mainly to develop tasks (i) and (ii), starting on mid-March 2023 (here, we prefer candidates with previous experience in the modelling of low-temperature plasmas).
- A two-year contract with an institution affiliated to IST, mainly to develop tasks (ii) and (iii), starting early 2024 (here, we prefer candidates with technical skills in the development of scientific software and of platforms for data storage, analysis, and visualization).

For more information, please contact Prof. Luís L. Alves at llalves@tecnico.ulisboa.pt
(message subject: "PSI.COM"; for an expression of interest please join your CV).
https://nprime.tecnico.ulisboa.pt/psi.com/

Contact:
Prof. Luís L. Alves
Instituto Superior Tecnico, Lisboa, Portugal
llalves@tecnico.ulisboa.pt

- **Post-doctoral Position in Thermal Plasma Technologies, Technological Institute of Aeronautics – ITA, Brazil**

The São Paulo Research Foundation (FAPESP), Brazil, announces a post-doctoral fellowship for a research project entitled "Development of a thermal plasma pyrolysis and inerting process applied to the treatment of sludge produced in Sewage Treatment Stations". This project will involve a collaborative network of research centers to investigate use of atmospheric pressure thermal plasma in material processing and energy generation. The postdoctoral researcher will explore the generation of thermal plasma and systems for thermal conversion of sludge from Sewage Treatment Stations into clean fuel gases suitable for use in the generation of steam or electric energy, as well as in inert solid material of high added value.

The research will be performed at the Plasma and Process Laboratory (LPP) of ITA (www.lpp.ita.br) located at the São José dos Campos, SP, Brazil. We are looking for candidates with Ph.D. in plasma science, engineering or a related field and experience in thermal plasmas and their application in material processing. The post-doctoral researcher must have excellent oral and written communication skills and the ability to supervise graduate students and collaborate with a team of multidisciplinary researchers.

The appointment for FAPESP's postdoctoral fellowship is generally 2 years, although an extension can be discussed. The selected candidate will receive R$8.479,20 per month and a Technical Reserve equivalent to 10% of the annual scholarship to cover expenses directly related to the research activity. If the postdoctoral fellow lives outside the city where the research institution is located and needs to move, he/she may be entitled to an installation allowance. More information about the FAPESP Post-doctoral Scholarship is available at www.fapesp.br/bolsas/pd.

Candidates must provide a letter of interest describing in detail their previous work experience, an updated CV and two letters of recommendation (in PDF format). All documents must be sent to the contact until **January 10, 2023**. Candidates with the greatest potential can be invited to an online interview.

Contact:
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Collaborative Opportunities

Please submit your notices for Collaborative Opportunities to iltpc-central@umich.edu.

Disclaimer

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