International Low Temperature Plasma Community

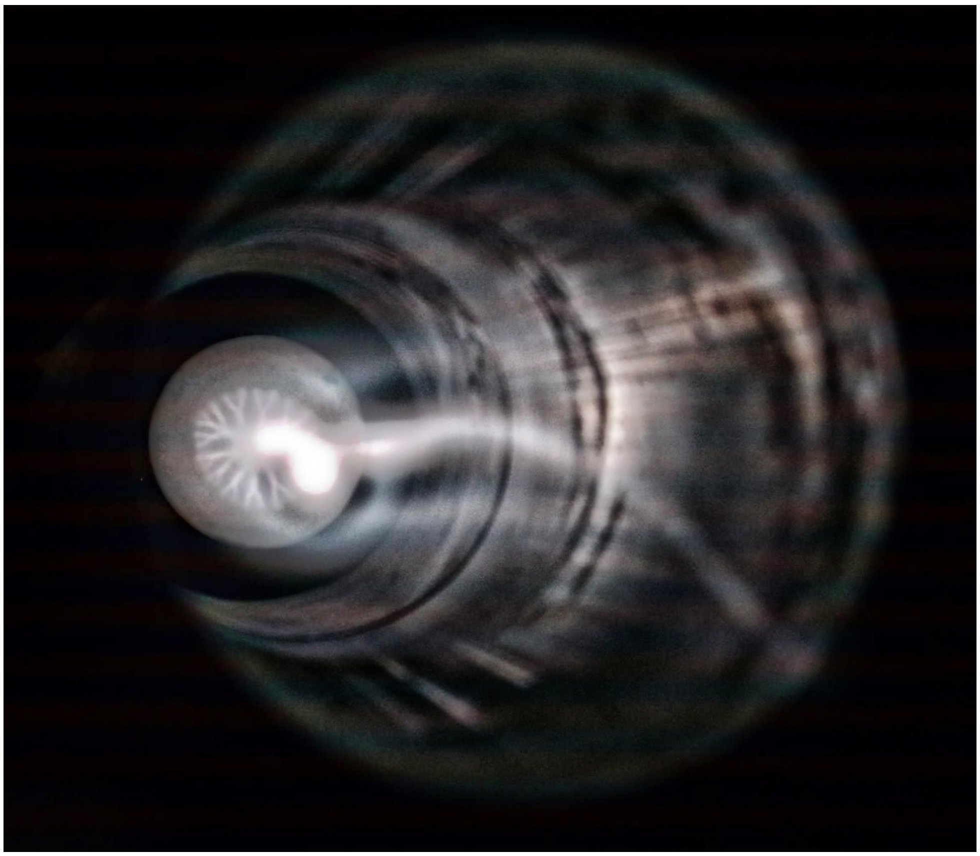
https://mipse.umich.edu/iltpc.php, iltpc-central@umich.edu

Newsletter 10

22 January 2021

Images to Excite and Inspire!

Thank you for submitting your images, some of which are shown here. Those images already submitted will appear in later Newsletters. Please do send your images (with a short description or source) to iltpc-central@umich.edu. The recommended image format is JPG or PNG; the minimum file width is 800 px.



Self-organization on the surface of an aluminum electrode driven at 162MHz. The plasma source is a coaxial VHF structure (J. Phys. D **45**, 195204 (2012). The working gas is argon at 760 Torr with 500 W applied RF power at 162MHz. Interestingly, this structure is only observed with argon. Helium, nitrogen, air, carbon dioxide, and ammonia did not exhibit such a structure. **Prof. Steven C. Shannon**, North Carolina State University, scshanno@ncsu.edu.

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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 **February 20, 2021**.

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_v03.docx. The highlight consists of an image and up to 200 words of text. The topic can be anything you want - a recently published work, a new unpublished result, a proposed new area of research, company successes, anything LTP-related.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.

LTP Perspectives: Policy, Opportunities, Challenges

Many Scales, Many Applications, One Discipline

The year 2020 confirmed that we cannot always predict what is going to happen, but our sustained focus on scientific inquiries and technological innovations can save the day, whether it is the vaccine that saves lives or the virtual platform that interconnects everything and everyone.

Low temperature plasma processing science, due to its intrinsic non-equilibrium nature, has been and will continue to be at the heart of many key enabling technologies and provided breakthrough solutions in areas of human health, energy, and environmental sustainability. In a challenging time like this, it seems timely to revisit the notion of LTP as one discipline spanning many scales and many applications, once featured at a Gordon Conference, and examine how it can be leveraged to overcome potential barriers and to have translational impact.

Fundamental studies focusing on plasma physics, kinetics, and chemistry revealed that, reaction specificity and selectivity can be achieved at low temperatures through a careful control of the energy and energy distribution of the species generated from the plasma (ions, electrons, vibrationally excited molecules, photons, etc), whether the application is for making the world smallest and most energy-efficient nanoelectronics, catalyzing carbon dioxide conversion or nitrogen fixation, or sterilizing and disinfecting surfaces and airborne particles. Identifying that common thread underlying various applications of plasma process science is challenging yet it holds promise to augment beyond the "sum of the parts," and to provide translational knowledge to enable technological breakthrough and accelerate innovations.

Two issues prior, Dave Graves encouraged diversity by stressing that we should not all be working on the same problems. Indeed, let's leave no plasma behind and embrace distinct problems, different ideas, various approaches, diverse members, and above all, share that common thread and lessons learned (both successful and unsuccessful) so we can avoid reinventing the wheel and make more progress.

The global LTP community has centers of excellence in many areas, and it would benefit from more international collaboration, leveraging the distributed talents and sharing that common thread, for the betterment of our societies. 2021 holds the promise of hope and a return to (a new) normalcy – *maybe* also an international gathering that would allow us to reconnect in person and chart the course of science without borders in LTP.

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Leaders of the LTP Community: Career Profiles

Jean-Michel Pouvesle – Innovating from X-rays to Plasma Cosmetics
(This profile was solicited by the editors of the ILTPC Newsletter.)

Jean-Michel (JM) Pouvesle, following a hugely productive career, last year became an emeritus CNRS researcher at GREMI, Orléans, France. JM had a solid education in physics and plasma physics which led him to promote the idea that: “To make advances, the problem should be clearly stated and the basics understood”. What can you learn from spectroscopy when you know the quantum physics? Why does a high voltage switch merge all of plasma physics? These are two examples of how JM recommends discussing physics. Start simple and understand the basics before moving on to the tricky and detailed analysis of any plasma physics topic. And please don’t reverse the process! Don’t imagine as a first step that things are complicated; because for sure they will be by the end!

Jean-Michel Pouvesle operates an atmospheric-pressure plasma that can propagate long distances to transfer excitation (patent WO/2009/050240), offering unique opportunities for, among others, electrodeless Plasma Gun endoscopy (E. Robert *et al*, Clinical Plasma Medicine **1** (2), 8-16, 2013).

Following this philosophy, JM overcame many challenges that produced many breakthroughs. Among them are: high pressure plasma generation with flash X-ray pumping, giant Gamma-ray radiation triggered with low power X-ray excitation, table-top capillary discharges for X-ray laser emission or EUV lithography, atmospheric pressure plasma streams for cancer treatment, and many more.

Why has JM and his philosophy been so successful? Because if you understand the basics, you can tailor your plasma for many applications. You can benefit from pulsed excitation to overcome gas breakdown and to control plasma temperature. You can leverage high pressure plasma kinetics for diagnostics, for generation of reactive species, for plasma transfer and propagation. JM’s message is: plasma is a fantastic tool when you know how to control it!

JM recommends that you should first learn the basics and then use those basic principles to try to imagine how things might happen. As you develop a plasma for a specific application, imagine how the basics flow through the system. Remain optimistic, remember the successes and failures, and share many of those experiences as possible with colleagues. Indeed, along with all his scientific achievements, JM always gives enthusiastic conference presentations where he shares ideas, results, analyses and confesses unknowns.

Two anecdotes about JM emphasize his optimism and kindness: First, JM is probably one of the very few scientists who have demonstrated perfect “express patent delivery” when he wrote the draft of one of his patents during a transatlantic flight, which was then filed within 24 hours of landing. The second deals with the best way you can engage JM – ask him about dose! Whatever you have in mind, X-ray, plasma or a specific cocktail, he is certain to invite you for a “Plasma Santé” toast.

The current topic JM is developing is plasma for skin treatment and cosmetics. Using plasma treatment, you can modulate sample surface features, favor transient drug penetration, tailor plasma sources for small or large spot treatment…And what you can do for mammalian cells or human tissues you can also plan to use it for plants. Following the example of Jean-Michel, plasma is and will stay a fantastic tool!

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General Interest Announcements

- **US Department of Energy Fusion Energy Sciences: Long Range Planning and LTPs**

  The US Fusion Energy Sciences Advisory Committee (FESAC) recently submitted a long-range plan for the office of Fusion Energy Sciences (FES) to the US Department of Energy. FES funds research in Fusion Science and Technology and Plasma Science and Technology, including low temperature plasmas. One of the major recommendations of the long-range plan is for FES to "establish a plasma-based technology research program focused on translating fundamental scientific findings into societally beneficial applications." This primarily pertains to research in low temperature plasmas, and it places low-temperature plasma sciences amongst the highest priority areas in the plan. Another high-level recommendation is to "support research that supplies the fundamental data required to advance fusion energy and plasma science and engineering." This recommendation is targeted at meeting data needs requirements of low-temperature plasma science, such as reaction rate coefficients and scattering cross sections. This report was the culmination of a two-year-long planning process that started with the APS-DPP Community Planning Process report, completed in March 2020, and now with the FESAC report entitled "Powering the Future: Fusion & Plasmas." The report can be viewed at: http://usfusionandplasmas.org.

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Meetings and Online Seminars

- **Online LTP Seminar**

  The Online Low Temperature Plasma (OLTP) Seminar series schedule for January – June 2021 is available at: https://mipse.umich.edu/ltp_seminars.php. The first seminars in the new series will be presented by Prof. Ali Mesbah (Deep Learning-based Controllers for LTPs) on **January 26, 2021** and Prof. Selma Mededovic (The Future of Water Purification by Electrical Discharge Plasmas) on **February 9, 2021**.

- **International Online Plasma Seminar (IOPS)**

  The International Online Plasma Seminar (IOPS) is a non-profit international seminar on low temperature plasma science with bi-weekly sessions via Zoom. Participation is free. The main purpose of the seminar is to make high quality research results in low temperature plasma science available to our community to foster scientific discussion. In this way presentations, that are otherwise only accessible at conferences, are available to anybody - including those who cannot attend classical onsite meetings due to travel restrictions, financial challenges, or other reasons. Following each presentation questions can be asked by all attendees. Based on the speaker's written consent, presentations will be recorded and will be made available for on-demand download. IOPS speakers can be nominated by anybody and are selected by the IOPS committee, which consists of editorial board members of Plasma Sources Science and Technology.

  The International Online Plasma Seminar (IOPS) has announced a new series of presentations for January – June 2021. The new seminar format includes:

  *Research Highlight (*20 minutes + questions): This presentation is intended to summarize a recent publication and is more highly focused on the topic of the publication.

  Tutorial/Review (30-45 minutes + questions): This presentation more broadly addresses a topic and is more like a traditional departmental seminar.

The program for IOPS is available at: https://mipse.umich.edu/online_seminars.php

To attend IOPS, use the following Zoom link:
https://ruhr-uni-bochum.zoom.us/j/93889931395?pwd=bFN5dU14RHRMYU5ySW40V1gvbDJpZz09

Speaker Nominations: Nominations are solicited for speakers for the July – December 2021 sessions of IOPS. Two types of seminars will be presented (please see above). Please submit nominations via the MIPSE website: https://mipse.umich.edu/online_seminars.php

- **MIPSE (Michigan Institute for Plasma Science and Engineering) Seminar Series**

The MIPSE seminar series, usually held as an in-person event, will be totally virtual this Winter. There will be five seminars during Winter 2021 covering the full range of plasma topics (not only LTP). The seminars are held on Wednesdays at 3:30 pm (US East Coast Time). The schedule and abstracts can be viewed at https://mipse.umich.edu/seminars_2021.php. Please send a request for the Zoom link to view the seminars to mipse-central@umich.edu. Seminars will be recorded and posted (with slides) at the same website.

Past MIPSE seminars (recordings and slides) can be viewed from: https://mipse.umich.edu/seminars.php.

Interviews of past seminar speakers can be viewed from: https://mipse.umich.edu/life_overview.php.

Contact:
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- **Hakone XVII – August 2022**

We have decided to postpone the Hakone XVII conference to 2022 in view of the ongoing uncertainties in vaccine scheduling in many countries. Fortunately, our original venue, the former Abbey Rolduc, is again available and we want to organize the conference there from 21 August 2022 to 26 August 2022. Please mark this in your calendar. We will inform you about new prices and deadlines in early summer 2021. More information will also become available on our website: www.hakonexvii.com.

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- **6th Healthcare and Life Science & Entrepreneurship Workshop, 29 and 30 April 2021**

6th "Int'l Healthcare and Life Science (HLS) & Entrepreneurship Workshop", April 29-30, 2021

Save the date, Call for papers

Lund University | NANO LUND AT THE FOREFRONT OF NANOSCIENCE | DTU | Vision Dynamics *Science & Entrepreneurship*

Location: Technical University of Denmark (TDU), Copenhagen

Venue: remote (for now, via Zoom) or at DTU

Scientific Chair & Host: Winnie Svendsen(DTU)

Scientific Chair: Heiner Linke (NanoLund)

Science Entrepreneurship Chair & Programme Director: Hugo de Haan (VD S&E)

Key topics and themes

- NanoBio surfaces
- Bio Polymers
- Human diagnostic devices
- Surface functionalization for coatings ar dispensing
- Antimicrobial/ antifouling coatings & dispensing
- Analytics, detection and imaging
- Drug delivery systems
- Nanomedicine
- Cell-material interaction
- Organ on chip devices
- Novel screening methods
- Bio-inspired and bio-based chemistry

Nominations of speakers may be suggested to josefien.vdlaar@visiondynamics.nl who will inform the ISC

More information: http://www.visiondynamics.nl/workshops/6th-nanobio-workshop

Following the successful Plasma Science & Entrepreneurship Workshop in November 2020, chaired by Prof. Dr. Achim von Keudell (RUB) and Prof. Guus Peemen (TU/e), low temperature plasma scientists, (potential) spinoffs of innovative plasma firms with applications in NanoBio / Healthcare & Life sciences are cordially invited to submit contributions for the 6th Healthcare and Life Science & Entrepreneurship workshop, 29 and 30 April 2021.
More information: http://www.visiondynamics.nl/workshops/6th-nanobio-workshop.

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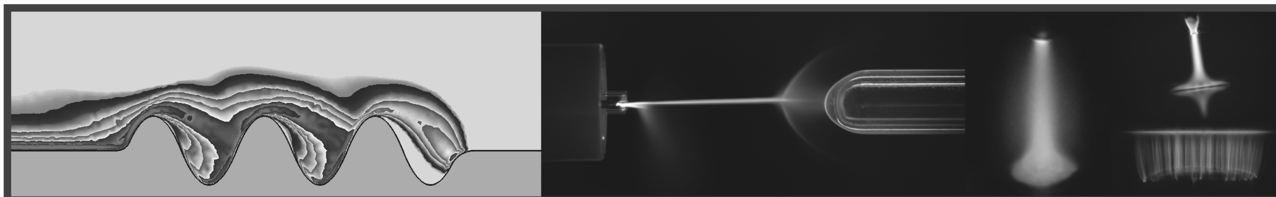
- **United States Low Temperature Plasma Summer School**

  An LTP Summer School is being planned for August 12-21, 2021 at the University of Minnesota. (Please see flyer below). Registration information will be announced in the near future.



1st United States Low Temperature Plasma Summer School

University of Minnesota, August 15-21, 2021*

** We are tentatively planning for an 'in person' summer school. We will make a final decision on the format of the school in late Spring 2021 in the case of continued Covid-19 concerns.*

Organizers: Peter J. Bruggeman (University of Minnesota), Mark J. Kushner (University Of Michigan)
Contact: pbruggem@umn.edu

Advisory board:

Jane Chang (University of California, Los Angeles)
Daphne Pappas (Plasmatreat, USA Inc)
Steven Shannon (North Carolina State University)
Uwe Czarnetzki (Ruhr University, Bochum)
Edward Thomas (Auburn University)

This initiative is inspired by the successful Low Temperature Plasma School in Bad Honnef, Germany. The School is intended to provide an opportunity for graduate students to be immersed in the fundamentals and applications of LTPs for one week and learn from leading researchers in their field. The US location will enable a new cohort of students to benefit from this offering. It is our hope this will also lead to strengthening a dynamic low temperature plasma community.

Day	Lecture Topics	Confirmed Lecturers
Mon	Introduction to plasmas Low pressure plasmas High pressure plasmas Magnetized plasmas and plasma wave interactions	Douglas Ernie (University of Minnesota) Uwe Czarnetzki (Ruhr University Bochum) Jose Lopez (Seton Hall University) Amitava Bhattacharjee (Princeton Plasma Physics Laboratory)
Tues	Plasma source design Plasma kinetics and reactions Plasma-surface interactions Dusty plasmas	Katharina Stapelmann (North Carolina State University) Uwe Kortshagen (University of Minnesota) Gottlieb Oehrlein (University of Maryland) Ed Thomas (Auburn University)
Wed	Modelling Diagnostics Hands on experience: Modelling (or) Hands on experience: Diagnostics	Mark Kushner (University of Michigan) Peter Bruggeman (University of Minnesota) Steven Shannon (North Carolina State University) Local organizers
Thu	Material processing: Low pressure Material processing: High pressure Environmental / agricultural applications Health applications Electric propulsion	Jane Chang (University of California, Los Angeles) Daphne Pappas (Plasmatreat, USA Inc.) Selma Mededovic Thagard (Clarkson University) David Graves (Princeton Plasma Physics Laboratory) Mitchell Walker (Georgia Institute of Technology)
Fri (AM)	Combustion and flow control Energy applications	Igor Adamovich (Ohio State University) Elijah Thimsen (Washington University in St. Louis)

Organized with the support of:

NSF

University of Minnesota
Driven to Discover℠

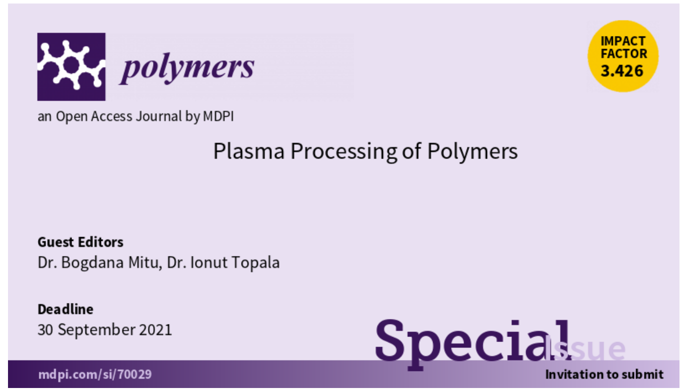
University of Michigan

Community Initiatives and Special Issues

- **2021 Special Issue *'Plasma Processing of Polymers'* to be published in *Polymers***

  The scope of this Special Issue will serve as a forum for papers on the following topics of interest, but will not be limited to these:

  - The plasma deposition of polymer-like thin films
  - The plasma synthesis of nano- and micro-composite materials with at least one polymeric component
  - The plasma cleaning and functionalization of polymer surfaces
  - The sterilization and disinfection of polymeric surfaces by plasma exposure
  - Reaction mechanisms and plasma-assisted chemistry
  - Plasma diagnostics, modelling and simulation for plasmas in polymerizable gases
  - Applications of plasma polymers in flexible (nano)electronics, sensors, separation and catalysis
  - Broadening the utilization of polymers in the textile industry by plasma processing



  The deadline for submissions is **30 September 2021**.

  More information:
  https://www.mdpi.com/journal/polymers/special_issues/plasma_processing_polymers

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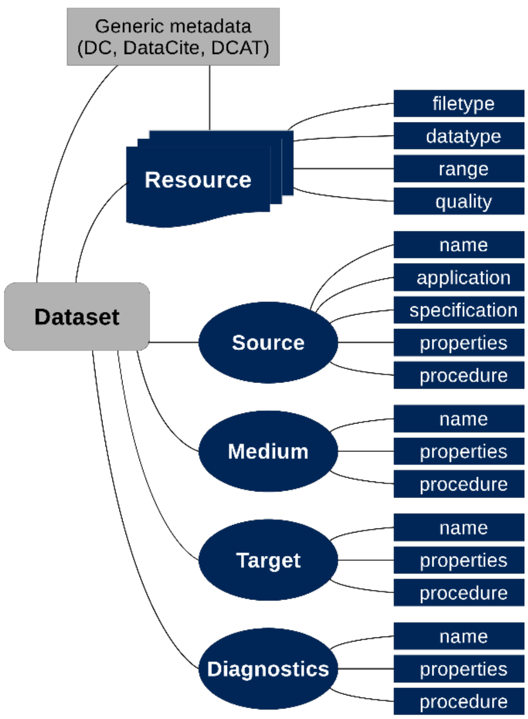
First Metadata Schema for Digital Assets in Applied Plasma Physics and Plasma Medicine



Overview of the schema elements and qualifiers of Plasma-MDS (blue). The sketch illustrates how the domain-specific schema extends general metadata of datasets according to basic metadata schemata like Dublin Core (DC), DataCite, or DCAT.

Taken from: Franke, St. *et al.,* Sci Data **7**, 439 (2020),

https://doi.org/10.1038/s41597-020-00771-0.

The Springer Nature Journal *Scientific Data* has published the first metadata schema for the description of digital assets in the field of applied plasma physics and plasma medicine, which is an important contribution to research data management in low temperature plasma physics. The authors pursue with their paper the goal of enabling a unified description of the strongly heterogeneous research data in plasma science with a general metadata schema. By means of the Plasma Metadata Shema (Plasma-MDS) it might be possible in the future to find relevant data and to use them for data driven research.

Research data repositories operated by INP in Greifswald (https://www.inptdat.de) and the Research Department "Plasmas with Complex Interactions" at Ruhr-University Bochum (https://rdpcidat.rub.de) already use Plasma-MDS to describe public datasets. The authors hope that the community will continue to develop this metadata schema and use it in other databases. For this purpose, public GitHub repositories for the data platform and the metadata schema have been set up at https://github.com/inpt-dat/. Documentation and linking of public datasets using Plasma-MDS and INPTDAT is already possible for the community at https://www.inptdat.de/add-dataset.

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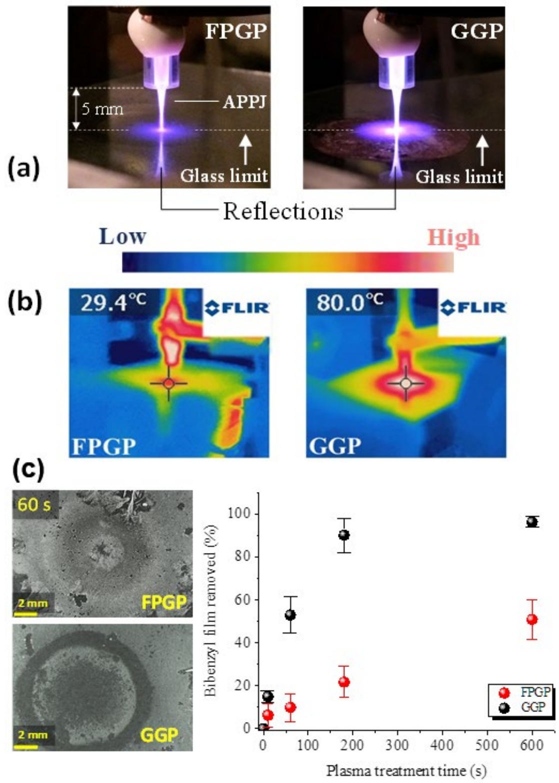
Source:
Sci Data **7**, 439 (2020)
https://doi.org/10.1038/s41597-020-00771-0.
https://rdcu.be/cdCKf
More information: https://www.plasma-mds.org

Experimental Investigation of a ns-pulsed Argon Plasma Jet for the Fast Desorption of Weakly Volatile Organic Compounds Deposited on Glass Substrates at Variable Electric Potential



(a) High-definition photos of the APJ (wavelength-integrated UV-VIS emission) impinging on a floating-potential glass plate (FPGP, left) and on a grounded glass plate (GGP, right). (b) False-color IR camera images used to evaluate the temperature of the glass plate at the impact spot of the APJ with a FPGP (left) and a GGP (right). **(c)** (left) Stereomicroscope images of resistant bibenzyl deposits plasma-treated for 60 s on a FPGP (top) and on a GGP (down); (right) calculated percentage of bibenzyl film removed from the glass surface as a function of the plasma treatment time for both electric potential conditions of the glass plate (obtained from several different deposits).

A ns-pulsed argon plasma jet (APJ) was studied for the fast desorption of bibenzyl deposited on glass substrates at variable electric potential (floating potential – FPGP and grounded – GGP). The experiments focused particularly on thin resistant bibenzyl films, which are more difficult to be desorbed when using a FPGP. The APJ was probed by means of high-resolution laser absorption spectroscopy to determine the Ar($1s_5$) metastable density at the close vicinity of the glass plate where bibenzyl was deposited. Furthermore, the APJ electrical, optical (OES, ICCD imaging) and thermal features were investigated. In this way, the plasma desorption efficacy (PDE) was evaluated for different exposure times of the bibenzyl molecules to the APJ (t_{exp}, from 10 s up to 600 s).

The results obtained confirm the low PDE in the case of a FPGP, which improves to some extent with increasing t_{exp}. For a GGP, though, the PDE is much more significant. Indeed, contrary to the case of a FPGP, an almost complete desorption of bibenzyl is achieved for t_{exp} over 180 s when using a GGP. PDE is attributed to a combined action of Ar($1s_5$) (up to 2×10^{13} cm^{-3}) with oxidative species (such as atomic oxygen, hydroxyl radical and ozone) and ions (such as N_4^+, Ar^+ and Ar_2^+). Furthermore, the plasma-treated deposits present concentric ring patterns resulting from a temporal superposition of filamentary streamers that propagate fast on the target. These are faster and exhibit a brighter emission when using a GGP. Thermal effects might also play a synergistic role but only when the glass plate is grounded, since relatively high gas and glass-surface temperatures (>60 °C) are reached only in this case.

The present APJ can be, therefore, adopted in various fields related to the fast desorption of weakly volatile organic compounds from different surfaces. for fast detection of resistant prohibited substances such as explosives and narcotics.

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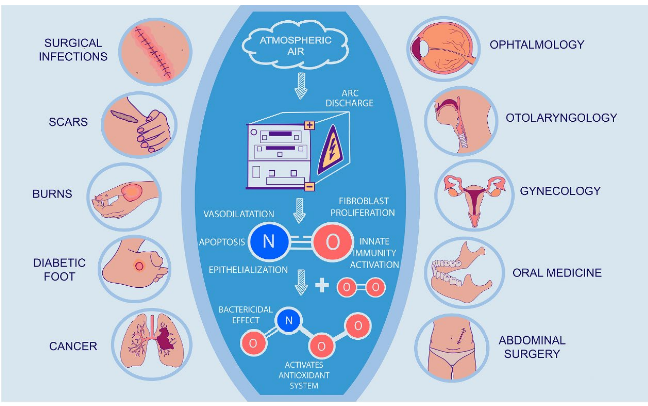
Source:
https://doi.org/10.1088/1361-6463/aba870,
https://doi.org/10.1002/ppap.201800080

Review of Clinical Applications of Nitric Oxide-containing Air-plasma Gas Flow Generated by the Plason Device



Schematic diagram of NO biological action and medical applications of NO therapy.

The studies published before 2006 and based on in vitro studies, animal experiments, and clinical experience demonstrated the beneficial effects of NO-therapy during all stages of the wound healing process. The application of NO-therapy facilitates wound cleansing through the activation of neutrophils and macrophages, angiogenesis intensification, fibroblasts proliferation and collagen synthesis. In the proliferative phase, NO stimulates the processes of epithelialization and enhances the involution of excess scars. Years of clinical experience with the Plason device prove the practical value of its beneficial effects including the inhibition of pain, swelling, hyperemia and the antibacterial effect. Universal mechanisms of NO-therapy accelerate the wound healing regardless of the location, reduce secondary complications and the rate and duration of hospitalization. Modern clinical data show the effectiveness of NO-therapy in wound healing purulent and abdominal surgery, in the treatment of traumatic and cicatricial lesions, including sports medicine, as well as in dentistry, ophthalmology, otolaryngology and in other areas of medicine. Developments are discussed in this newly published review.

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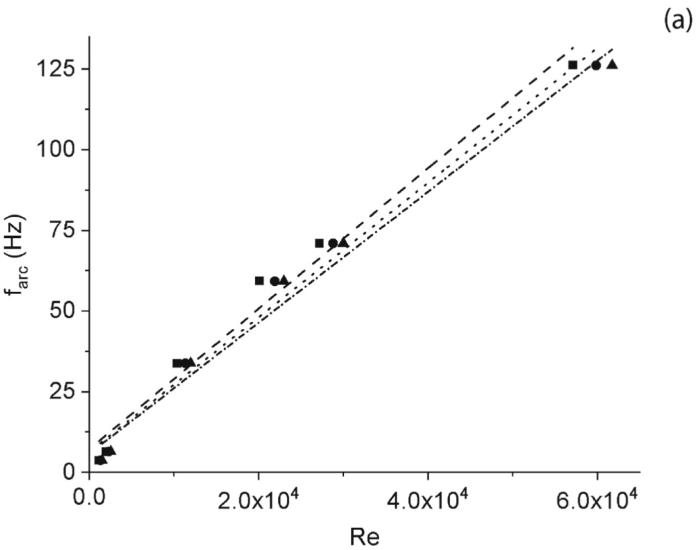
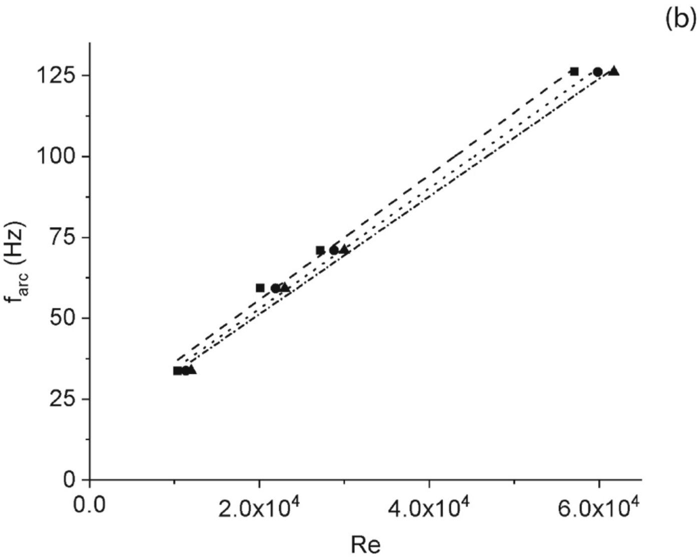
Source:
A. V. Butenko *et al*, Clinical Plasma Medicine, **19–20**, September–December 2020, 100112.
https://doi.org/10.1016/j.cpme.2020.100112

Influence of Gas Dynamics on Arc Dynamics and the Discharge Power of a Rotating Gliding Arc





Measured and fitted arc rotational frequency (f_{arc}) as a function of Reynolds number (Re): (a) considering laminar and turbulent cases; (b) considering only turbulent cases. A good fit is seen with a R^2 of (a) 0.98 and (b) 0.99 shown by dashed (--), dotted (□) and dash-dotted-dash (□) lines for z/D = 1.25 (!), 1.5 (●) and 1.75 (▲), respectively. The slope of the linear fit is 0.002 for all the cases of z/D in (a) and (b). The intercept value is seen varying for z/D = 1.25, 1.5 and 1.75 as follows: (a) 7.24, 6.37 and 5.84, respectively; (b) 17.18, 15.73 and 14.94, respectively.

This work reports on the design and characterization of a rotating gliding arc (RGA) reactor developed with a novel electrode configuration. The arc rotational frequency (f_{arc}) measured from (1) a high-speed camera (HSC) and (2) fast Fourier transform (FFT) analysis of voltage, shows linear dependency on the Reynolds number (Re) calculated from CFS, with an $R^2 = 0.98$. The agreement improves ($R^2 = 0.99$) by applying linear fit only for the cases having turbulent Re. A close match between gas rotational frequency (f_{gas}) calculated from CFS and experimentally measured f_{arc} is seen. The turbulent regime of the gas flow causes: (1) twisting and bending of the arc; (2) sawtooth-like voltage fluctuations with irregular and non-sinusoidal waveform; and (3) arc blow off. The high-frequency voltage fluctuations were reduced/absent when the flow Re reduced from $\approx 6.0 \times 10^4$ to $\approx 1.0 \times 10^4$. These findings establish that the gas dynamics, in particular, the bulk flow phenomenon of the gas, has an explicit influence on arc dynamics of the RGA reactor.

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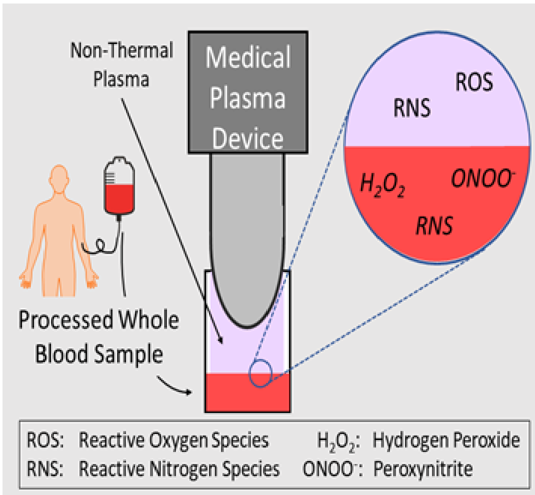
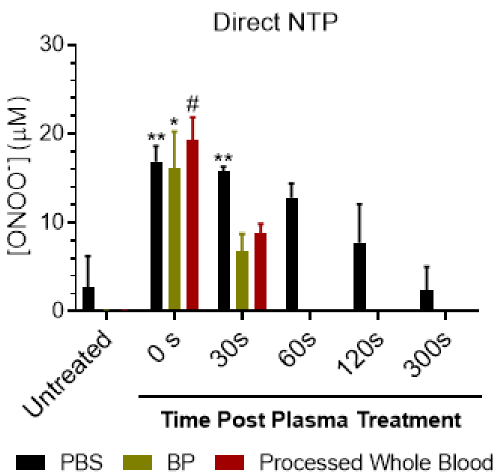
Source:
https://doi.org/10.1088/1361-6595/ab2169

Critical Evaluation of the Interaction of Reactive Oxygen and Nitrogen Species with Blood to Inform the Clinical Translation of Non-thermal Plasma Therapy





Blood plasma (BP) and processed whole blood from healthy volunteers were treated with direct and indirect NTP and analyzed for RNS, H_2O_2, and $ONOO^-$. To assess the stability of these species after treatment, the sample was analyzed immediately (0 s) or after a delay (30-300 s). Treatment of PBS was performed to determine the baseline concentrations of NTP-generated ROS/RNS.

The aim of our work was to elucidate the stability of reactive oxygen and nitrogen species (ROS/RNS) in blood following non-thermal plasma (NTP) treatment. Most preclinical research to study NTP-generated ROS/RNS has been performed in phosphate buffered saline or cell culture medium, but these solutions do not properly represent the clinical setting. Since NTP-generated ROS/RNS will inevitably contact blood in several clinical contexts, both deliberately (e.g. hemostasis) or inadvertently (e.g. cancer therapy), it is crucial to study how NTP-generated species interact with different components of blood.

Direct and indirect NTP delivery modalities were used to treat 3 solutions with increasing organic complexities: phosphate-buffered saline (PBS), blood plasma, and processed whole blood. NTP-generated RNS collectively, H_2O_2, and $ONOO^-$ alone were analyzed over time. NTP-generated RNS and H_2O_2 were stable in PBS but scavenged by different components of the blood. Our previously developed luminescent probe was used for precision measurement of $ONOO^-$ and revealed that NTP-generated $ONOO^-$ was temporally stable in all 3 liquids.

Based on our results, we highlight the selectivity of our assays and discuss the necessary considerations for clinical translation of both NTP modalities.

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New Resources

Please submit your notices for new resources (e.g., newly published special issues, new databases, new reviews) to iltpc-central@umich.edu.

Career Opportunities

- **Post-Doctoral Research Fellow in Plasma Source Characterization at INP Greifswald**

  The INP is a collaborative laboratory in Greifswald, Germany with a BMBF funded project to investigate cold atmospheric pressure plasma application in intensive care. The project involves development, adaptation, and characterization of plasma devices in order to make plasma application useful and accessible for intensive anti-viral care. We offer a post-doctoral position in Greifswald starting on 1 April 2021 for a 3 year-fixed term contract. Responsibilities for the position include:

  - Design, adjust and operate cold atmospheric plasma (CAP) devices and CAP device systems for direct and indirect anti-viral application
  - Correlate the CAP effectivity to anti-viral application with plasma, liquid and gas phase diagnostics
  - Supervise students and Phd students within the project
  - Adjust CAP development to medical regulations and apply for patents
  - Interact with an interdisciplinary team from physicists to medical stuff and present scientific results
  - Publish scientific results on scientific conferences and in peer reviewed journals
  - Acquire third party funds and lead scientific projects

  Please apply with a cover letter, CV, references with the subject line "0392 Post Doc Plasma Source Characterization" by **15 February 2021**. Applications should be sent to **Mrs. Gabriele Lembke**, Human Resources Department, bewu@inp-greifswald.de. You can also apply through the online system at http://www.leibniz-inp.de.

  Contact:
  Dr. Torsten Gerling
  Research Group Leader "Plasma Source Concepts"
  Leibniz-Institut für Plasmaforschung und Technologie e.V. (INP)
  gerling@inp-greifswaldc.de

- **Opportunity for a PhD in Chemical Engineering at McGill University, Montréal, Canada: Non-thermal Hydrogen Plasma Reduction of Iron Oxide Powder**

  This project at McGill University, Montreal, Canada, involves the development of a continuous flow atmospheric pressure non-thermal hydrogen plasma process for the reduction of iron oxide powder. The main steps of the project are: 1. Design, construction, testing and optimization of the plasma source; 2. Correlate the processing conditions with the reduction conditions through basic plasma spectroscopy and electrical measurements; 3. Study the morphological and chemical composition changes to the powders; 4. Fundamental study of the plasma-powder interactions to explain the trends observed experimentally. The candidate who will be selected demonstrates a strong knowledge in chemical processing and material sciences, and a keen interest to acquire expertise in plasma processing and plasma-surface interactions. The project is co-funded by the McGill Sustainability Systems Initiative under the CleanTech for Climate Action theme and is part of a larger project aiming the use of iron powders as a recyclable metal fuel. Ideal start date is Sept. 2021. Application for PhD must be completed before **February 15, 2021**.

  Contact:
  Prof. Sylvain Coulombe
  McGill University
  Plasma Processing Laboratory
  sylvain.coulombe@mcgill.ca

- **Post-Doctoral Position in Space Plasma Propulsion at the Laboratoire de Physique des Plasmas (LPP), Ecole Polytechnique, France**

  Nowadays, electric satellites represent more than 50% of an increasingly competitive satellite market. Among the different electric propulsion systems, Hall Thrusters are developed in France by SAFRAN and have successfully been sold as satellite propulsion engines for orbital propulsion and control of space probes and satellites. A key issue for SAFRAN is now to develop low power (300-500W) thrusters to address the exploding market of small satellites in low-Earth orbits (i.e., at altitudes from 500 to 2000 km).

  To improve the fundamental understanding and accelerate industrial development, the low-temperature plasma team at LPP is involved in a long-term research project funded by SAFRAN aiming at a better understanding of the physics of Hall Thrusters. Since 2014, the focus has mainly been on numerical simulation and theory. The LPP team now has a 24-month post-doctoral position to develop advanced optical emission spectroscopy and imaging for fundamental studies and model validation. The post-doc work is divided into two tasks:

  - Develop time and space resolved optical emission spectroscopy and imaging of the channel of a Hall Thruster installed in the propulsion facility test chamber at LPP. The recorded spectrum and the time fluctuations will be compared to synthetic spectrum and fluctuations generated by 2D Particle-In-Cell Simulations compared to Collisional Radiative models.

  - Develop a miniaturized and space flight proven imaging system that will be embarked on a flying satellite within the EU CHEOPS LOW POWER project. The goal is to compare the emission signature of a flying model to the one recorded in ground test facilities to understand the differences already reported between ground and flight engine operation.

  The candidate should be familiar with low pressure magnetized plasmas or ideally Hall Thrusters, and/or expert in optical imaging and optical emission spectroscopy in plasmas.

  For further information about the post-doc position, please contact:
  Dr. Anne Bourdon, anne.bourdon@lpp.polytechnique.fr
  Dr. Pascal Chabert, pascal.chabert@lpp.polytechnique.fr
  Dr. Thomas Charoy, thomas.charoy@lpp.polytechnique.fr
  Laboratoire de Physique des Plasmas (LPP), Ecole Polytechnique, France

Collaborative Opportunities

Please submit your notices for collaborative opportunities to iltpc-central@umich.edu.

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