

## AAPPS-DPP Plasma Innovation Prize – Professor Miran Mozetič is selected as Sixth Laureate (2024) –

The Division of Plasma Physics (CEO: Mitsuru Kikuchi, Chair: Abhijit Sen) under the Association of Asia Pacific Physical Societies (President: Hyoung Joon Choi) selected Professor Miran Mozetič of Jozef Stefan Institute, Slovenia as the 6th Laureate of AAPPS-DPP Plasma Innovation Prize, which is awarded to scientists who have made seminal / pioneering contributions in the field of plasma applications, focusing on impacts on industry.

Citations:

**Miran Mozetič:** *For his outstanding contributions to the development and commercialization of selective plasma surface functionalization and etching technology for polymers and polymer blends; for developing unique tools for spatio-temporal density measurements of atoms in weakly ionized plasmas and plasma afterglows, that have helped elucidate the plasma surface treatment mechanisms; for employing the techniques for mass production and commercialization of composite commutators and sensors for plasma radical measurement.*



### *AAPPS-DPP Innovation Prize*

*is awarded by Division of Plasma Physics, AAPPS  
for outstanding contribution to the field of Plasma Applications.*

*The 2024 Prize is awarded to*

*Miran Mozetic*

*For his outstanding contributions to the development and commercialization of selective plasma surface functionalization and etching technology for polymers and polymer blends; for developing unique tools for spatio-temporal density measurements of atoms in weakly ionized plasmas and plasma afterglows, that have helped elucidate the plasma surface treatment mechanisms; for employing the techniques for mass production and commercialization of composite commutators and sensors for plasma radical measurement.*



Abhijit Sen  
Chair of DPP



Sudeep Bhattacharjee  
Chair of Selection  
Committee

4 November, 2024

### Certificates of 2024 Plasma Innovation Prize

Certificate, medal and cash prize will be given at the 8th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2024) Nov. 3-8, 2024 at Malacca, Malaysia.

**Contact points** : AAPPS-DPP Association Inc. : Representative Director and CEO, Mitsuru Kikuchi, TEL: +81-80-1115-3482, AAPPS-DPP Homepage Address : <http://aappsdpp.org/AAPPSDPPF/index.html>

## On the achievements of Professor Miran Mozetič



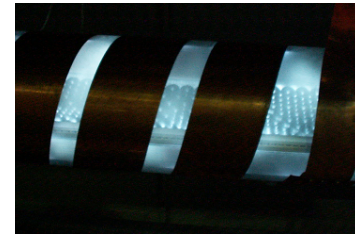
Prof. Miran Mozetič

Prof. Miran Mozetič was born in Ljubljana, Slovenia, in 1961 and received his PhD in Electronic Vacuum Technologies at the University of Maribor, Slovenia. Since 2009, he has been the Head of the research team of Thin Film Structures and Plasma Surface Engineering, and since 2010, he has been a professor at the International Postgraduate School in Ljubljana, Slovenia.

Prof. Miran Mozetič accomplished the following great inventions for the plasma processing of various materials.

**Firstly**, he developed a method for plasma treatment of polymer composites which enables direct electrochemical metallization, and constructed a production line. Over 30 million pieces annually have been produced

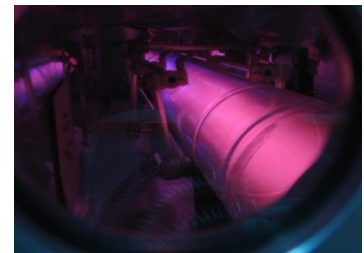
for over a decade. Innovative coupling of the radiofrequency generator enables uniform treatment of numerous products in a batch mode.



RF plasma selective etching of polymer composites

The **second** technology developed by Prof. Mozetič is a method for sustaining low-pressure plasma in water at atmospheric pressure. The method is based on establishing a stable bubble by super-cavitation. The electrodes are immersed into the bubble, which is at water vapor saturated pressure. The relatively long lifetime of OH radicals at this pressure (as compared to classical atmospheric-pressure plasmas) and the fast speed of water passing the super-cavitation bubble enable rapid inactivation of viruses in the water.

The **third** plasma technology is the deoxidation of metals with hydrogen plasma in the continuous mode. Prof. Mozetič developed a method and constructed a production line. Uniform plasma is sustained in a reactor with a length over 10 m using a quadrupole coupling of the radiofrequency generator because classical coupling is not suitable due to the too-large impedance of a long coil.



Quadrupole coupling for uniform hydrogen plasma

**Fourthly**, Prof. Mozetič developed a method for rapid activation of fluorinated polymers. The products made from Teflon or similar materials are treated with hydrogen plasma for a second or less. The synergy between vacuum ultraviolet radiation and hydrogen atoms causes C-F bond scission and the formation of a very thin polyolefin layer on the surface of fluorinated polymers. In the second step, the products are treated with neutral oxygen atoms to ensure a super-hydrophilic surface finish of these hydrophobic materials.

The **fifth** plasma technology developed by Prof. Mozetič is for treating seeds in the continuous mode. He constructed an 8-m-long trailer, which is used at farms for the detoxification of seeds, disinfection, and surface activation, which enables a super-hydrophilic surface finish of the seeds and, thus, a rapid water uptake after sowing. The capacity of the device for seed treatment is over 1 ton/hour, and treatment uniformity is achieved by falling seeds through a vertical plasma reactor.



A movable device for seed treatment

The inventions are documented in 20 patents granted by EU and/or US offices. Prof. Mozetič has co-authored over 400 scientific articles and given about 100 invited, keynote, or plenary lectures at periodical scientific conferences or workshops. His scientific achievements provided a solid background for applied and industrial projects, and his specialty is upscaling the innovative solutions and construction of large low-pressure non-equilibrium plasma reactors that have been used in industry for mass production.

## Appendix: 2024 AAPPS-DPP Plasma Innovation Prize

AAPPS-DPP Plasma Innovation Prize was founded by the AAPPS-DPP in 2019. This prize is given to a plasma physicist/engineer annually to recognize outstanding contributions to experimental and/or theoretical research in all fields of plasma applications, focusing on impacts on industry. The prize recipients were Professor Roderick Boswell (2019), Masaru Hori (2020), Dr. Anthony B Murphy (2021), no winner (2022), Takayuki Watanabe (2023). The 2024 Selection Committee composed of leading physicists of plasma application in Asia-Pacific region.

Selection committee:

Chairman: Prof. Sudeep Bhattacharjee (Indian Institute of Technology Kanpur)  
Members: Prof Nor Aishah Saidina Amin (University of Technology Malaysia)  
Prof Se Youn Moon (Chonbuk National University)  
Prof Hae June Lee (Pusan National University)  
Prof Quan-Zhi Zhang (Dalian University of Technology)  
Prof Yi-Kang Pu (Tsinghua University)  
Prof Toshiro Kaneko (Tohoku University)  
Dr Masaru Izawa (Hitachi Hightech Co Ltd)  
Prof Alphonsa Joseph (Institute for Plasma Research)  
Prof Kwo Ray Chu (National Taiwan University)  
Prof Patrick J Cullen (University of Sydney)



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INDIAN INSTITUTE OF TECHNOLOGY KANPUR

भौतिकी विभाग  
DEPARTMENT OF PHYSICS

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Dear Prof Kikuchi and Prof Sen,

I have great pleasure in conveying the decision of the Selection Committee of the AAPPS-DPP Plasma Innovation Prize 2024.

The Selection Committee recommends that the AAPPS-DPP Plasma Innovation Prize for the year 2024 be awarded to Professor Miran Mozetič from Jozef Stefan Institute and Plasmadis Ltd., Slovenia.

The proposed award citation for the awardee is as follows:

Miran Mozetič : "For his outstanding contributions to the development and commercialization of selective plasma surface functionalization and etching technology for polymers and polymer blends; for developing unique tools for spatio-temporal density measurements of atoms in weakly ionized plasmas and plasma afterglows, that have helped elucidate the plasma surface treatment mechanisms; for employing the techniques for mass production and commercialization of composite commutators and sensors for plasma radical measurement."

The committee met online via video conferencing on 29th August, 2024 and looked at the scores and comments provided, and had a good discussion on selection of winner. The Award Winner was unanimously approved by all those who were present, including another member who could not be present in the meeting but sent his approval through email (9 out of 11 committee members were present in the meeting).

Best regards,



Sudeep Bhattacharjee

Dated: September 2, 2024

Chair, Plasma Innovation Prize Selection Committee 2024

CC: PIP 2024 Selection Committee