

94th IUVSTA Workshop on reliable sensing and control of reactive plasmas,

29th May to 2nd June 2022, Kranjska Gora, Slovenia

Workshop webpage: <https://www.plasmadis.com/wp/94th-iuvsta-workshop/>

Workshop scope:

Society is facing the fourth industrial revolution, often referred to as Industry 4.0. Industry 4.0 refers to the concept of factories in which machines are augmented with wireless connectivity and sensors, and in a broader sense, also to the development of production processes that are compatible with the major concept. Current plasma technologies do not meet the standards of Industry 4.0 because of the lack of reliable sensors for real-time monitoring of plasma parameters and surface end-point. Plasma scientists face a tremendous challenge: the development of reliable and inexpensive sensors, which should be capable of integration into smart production lines.

The 94th IUVSTA Workshop on reliable sensing and control of reactive plasmas gathered leading scientists in plasma sensors to discuss recent achievements in sensing technology as well as drawbacks of currently used sensors. Innovative sensors will have to be developed within the next decade. The key requirement is reliability. The accuracy is not crucial as long as a broad range of treatment parameters is tolerable – often by choosing discharges capable of self-adjustment. The sensors' response should be predictable and thus suitable for integration in digital twins. Distinguished scientists from world-leading groups in this field attended the Workshop.

The 94th IUVSTA Workshop on reliable sensing and control of reactive plasmas was organized by the Slovenian Vacuum Society and supported by the International Union for Vacuum Science, Technique and Applications. IUVSTA supports a few Workshops annually. Workshops provide a forum for intense debate and discussion between a small number of experts in a focused scientific or technical field that falls within the area of activity of the Scientific Divisions of IUVSTA. The 94th IUVSTA Workshop on reliable sensing and control of reactive plasmas was supported by the Plasma Science and Technology Division of the international union IUVSTA.

Venue and program:

The Workshop was organized in Hotel Best Western in the village of Kranjska Gora at the brink of Julian Alps. The workshop participants gathered on Sunday, 29th May 2022. They were welcomed upon arrival at the Hotel and spent the Sunday afternoon discussing in small groups. The formal program started with registration and a welcome reception on Sunday evening. During the next four days (Monday till Thursday), the invited scientists presented recent achievements in the workshop topic and guided topical discussions were organized. The guided discussions were organized in round tables with the following topics:

- Innovative plasma sensors;
- Powerful atmospheric pressure plasmas;
- Plasma technologies in Industry 4.0.

The invited speakers were selected from renowned researchers in the niche of plasma sensing. Experts from all over the world were invited, but the invitees from Asian countries could not attend due to the travel restrictions because of the Covid measures. The invited participants came from Austria, Croatia, the Czech Republic, France, Germany, Hungary, Ireland, Serbia, Slovenia, and the US.

The program of the Workshop is in the table below.

| | Sunday, 29 th May | Monday, 30 th May | Tuesday, 31 st May | Wednesday, 1 st June | Thursday, 2 nd June |
|-------|------------------------------|------------------------------|--|--|--|
| 09:00 | | Registration | | | |
| 09:20 | | Opening ceremony | | | |
| 09:25 | | I1 - Belmonte | | I9 - O'Connell | Round table on plasma technologies in Industry 4.0 |
| 10:00 | | I2 - Gans | | I10 - Gorjanc | |
| 10:35 | | I3 - Kersten | Excursion with lunch | I11 - Sunkara | |
| 11:10 | | Coffee break | | Coffee break | |
| 11:50 | | I4 - Puać | | I12 - Schneider | |
| 12:25 | | I5 - Zaplotnik | | I13 - Špatenka | |
| 13:00 | | Lunch break | | Lunch break | Closing remarks and lunch |
| 14:30 | | I6 - Krstulović | | I14 - Kutasi | |
| 15:05 | | I7 - Kargl | Guided discussion on innovative plasma sensors | I15 - Mozetič | |
| 15:40 | | I8 - Day | | I16 - Lehocky | |
| 16:15 | | O1 - Kathage | | O2 - Radičić | |
| 16:35 | Registration | Coffee break | | Guided discussion on powerful atmospheric pressure plasmas | |
| 17:30 | | | Poster session | | |
| 18:30 | Welcome cocktail | | | | |
| 19:00 | Dinner break | Dinner break | Dinner break | Dinner break | |



Some highlights of the Workshop



Figure 1: The 94th IUVSTA Workshop was chaired by Miran Mozetič (Slovenia).



Figure 2: Thierry Belmonte presented challenges in probing plasma parameters in liquid media

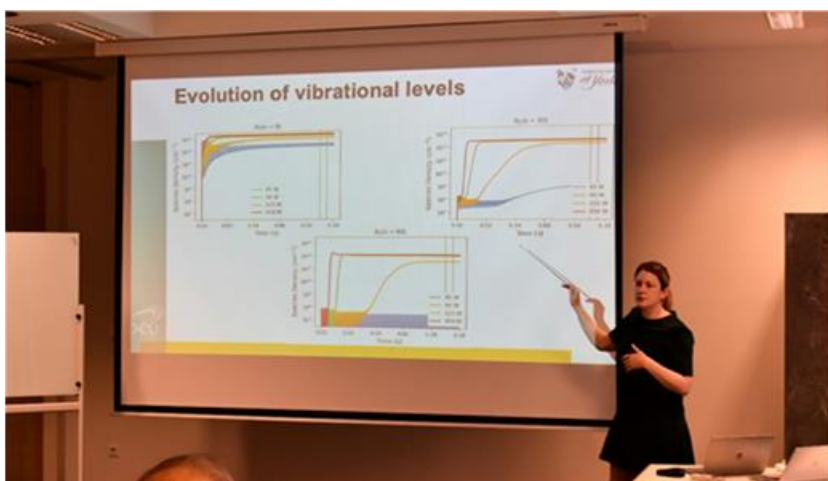


Figure 3: Deborah O'Connell presented challenges in probing nitrogen vibrational states

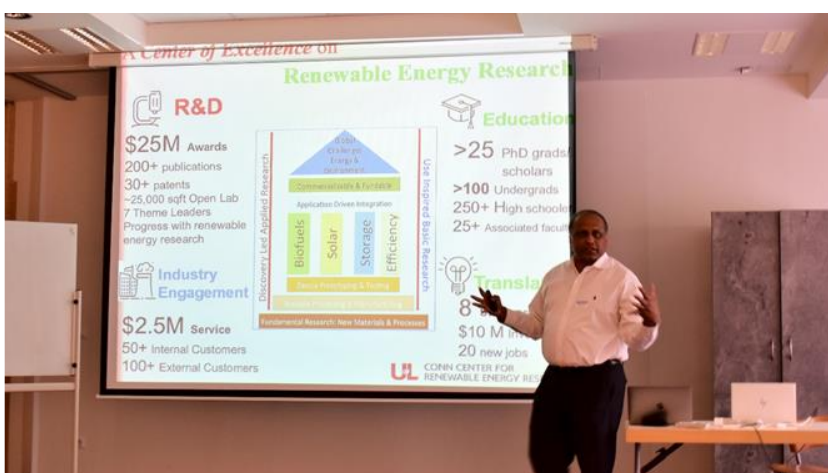


Figure 4: Mahendra Sunkara discussed the need for controlling plasma parameters in atmospheric plasmas



Figure 5: Marija Gorjanc discussed plasma parameters useful in the treatment of textiles



Figure 6: Holger Kersten presented innovative probes for measuring particle and energy fluxes



Figure 7: Nevena Puač stressed the need for characterizing plasma used in modern agronomy



Figure 8: Viktor Schneider presented an innovative probe for measuring potential in plasma sheath



Figure 9: Kinga Kutasi discussed the reliability of sensors for characterizing plasma in gas mixtures



Figure 10: Timo Gans discussed limitations in probes for characterizing oxygen plasmas

The Workshop was organized by members of the Slovenian vacuum society. The financial support from International Union for Vacuum Science, Technique and Applications (IUVSTA) is gratefully acknowledged. No proceedings of this Workshop were published because the aim of the Workshop was to discuss open issues rather than present the final solutions.

President of DVTS

Prof. Alenka Vesel, Ph.D.

