

Report on IMPI's 58th Annual Microwave Power Symposium, 29-31 May 2024 at Reston Town Center, suburban Washington, D.C.

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The venue for the 58th IMPI conference was Reston Town Center, 21 miles west of Washington, D.C.. Founded in the 1980s, Reston Town Center is built around a Fountain Square (**Figure 1**) with open avenues and pathways, noted for its Garden City design, and was a pleasant, calm location for the conference. In keeping with IMPI conferences, the hotel venue doubled as delegate accommodation which maximised opportunities for networking.



Figure 1. View of fountain square in Reston town center.

As usual, a day of short courses preceded the main 2 day conference. Immediately after the short courses, an Exhibitor Showcase took place with an impressive 18 exhibitors in attendance (**Figures 2, 3**) with a well-attended welcome reception buffet to kick-off lots of reacquaintances between old colleagues and plenty of new networking opportunities for everyone. Solid state (components, systems) were the dominant technology theme of the exhibitors.

The conference itself was opened by the Program Committee Chair, Prof Reeja Jayan with contributions from Ralph Bruce, Programme Vice-Chair, and John Gerling, IMPI President.

The conference had 118 registrations from 13 countries, with a student talk competition and 43 presentations in total. Two special sessions were

included on Industrial Applications and THz Technology.



Figure 2. Welcome reception buffet during the exhibitor showcase.



Figure 3. Further photo of the welcome reception buffet during the exhibitor showcase.

The first presentation was a Keynote from Christina Wildfire from the US National Energy Technology Laboratory. She talked through her team's experiences and pain points in the development of microwave technologies particularly for conversion of materials into energy or value added products. The group is investing in facilities to complement lab facilities to better understand industry scale applications, and plan to pilot promising microwave chemistries in 2024 to scale-up.

A plenary session (**Figure 4**) followed on Biomedical and Bioengineering applications. David Vennin (Sairem) showed results from a pilot 54kW 915MHz continuous flow reactor (80 mm diameter, 1500 mm long tube), for decontamination of wheat grains. Capable of treating 1015 kg/h wheat grain, with an 8 sec microwave treatment time, total bacteria count reductions matched conventional methods. It was interesting that the microwave approach is a similar cost to conventional methods, but grain quality is improved.



Figure 4. Plenary session.

Parallel sessions followed on Chemistry & Plasma, and Food Technology. Solid state investigations were a recurring theme from presenters. Purposeful frequency shifting (typically over 2.4 to 2.5 GHz) for improved heating uniformity and avoided overheating was shown by several authors. Scale-up challenges (e.g. energy cost comparison to magnetrons) still need further research to deliver the process benefits.

Further parallel sessions on Solid State applications and Dielectric Properties were followed by the Annual IMPI Business meeting. IMPI currently has 211 members of which 29 are corporate members. Arjun Ghimere received the RF Schiffmann Memorial Scholarship award for 2024.

Day 1 ended with the conference dinner at the *Fogo de Chao* Brazilian steakhouse, a delighted experience with meat served from skewers at your table.

Day 2 kicked off an announcement on the newly elected IMPI Executive Board effective 1st

June. John Mastela (JFM Technical) as President, Brian Blackwell (Odyssey Technical Solutions) as Vice President, Sean McKeown (Graphic Packaging International) as Treasurer and Candice Ellison (USDA-ARS) as Secretary. John F. Gerling (Gerling Consulting) will remain on the Exec Board as the Immediate Past President.

The keynote was delivered by your author, John Bows, on microwave process solutions to deliver positive food choices for consumers. This was from the perspective of large food companies, who own their own factories and process lines, hence it's much harder for them to disrupt highly cost-efficient processes with more expensive microwave-assisted processes. Successful commercialisation requires breakthrough thinking across finance, marketing, supply chain and R&D functions. The outlook for commercialising microwave processes is improving (for large food manufacturers) with increasing nutrition regulations (e.g. nutrient labelling front-of-pack), the electrification agenda and strategic statements from major food companies to offer more healthy food choices to consumers.

Parallel sessions followed on Modelling and Industrial Process Equipment followed by a plenary on Industrial Applications. Various topics were covered spanning particle beds, tuning considerations, catalysis, plasma torches, nanomaterial synthesis, ammonia and oxide syntheses.

The Day 2 final session was on THz technology. THz defined as 100 GHz to 10 THz (3 mm to 30 micron), historically a gap between photonic and optical techniques, though this gap has narrowed as devices creep into THz frequencies. With established applications in spintronics, astronomy, quantum optics and communications (6G), THz overlaps water relaxational motions and intermolecular vibrations of water and biomacromolecules, so could have interested biological effects.

Permittivity measurements for extreme temperature conditions was presented by Cesar Nieves, Air Force Research Lab. In hypersonic flight, aircraft Radomes can reach 1000-1500°C hence dielectric properties at these temperatures are important for material characterisation. Marzena Olszewska-Placha (QWED) presented on low

temperature GHz and THz characterisation of ceramic materials. Driven by demanding new material requirements for 5G/6G & THz communications, co-fired glass ceramics at very low temperatures (<650°C) offer advantages in their material properties.

A Spotlight Panel on opportunities for young professionals was moderated by Beeja Jayan. Early career panellists Cesar Nieves, Jacob Sturgis, Zane Cohick and Aniruddh Vashisth talked about their route into their “RF engineering roles”. Surprisingly, none are electrical engineers, and fell into their jobs serendipitously, learned on the job through hands-on experimentation. A lively Q&A followed with the

audience on handling failure, biggest struggles, role of mentors, 5 year plan, and IMPI could support early year careers.

Throughout the 2 days, delegates networked and had refreshment & lunch breaks in the same room as the Exhibitors and posters, which greatly enriched the experience for all. The all-in-one venue location provided by a large hotel has its merits.

The conference closed with awards for Best Poster to Ryo Ishibashi, Best Oral Presentation to Anna Maria Cavazzini, and the announcement that IMPI 59 will be held 24-26 June, 2025 in Westin Edmonton, Alberta, Canada.