MMA'23 Mainz, Germany, September, 25 - 28

12th INTERNATIONAL CONFERENCE ON MICROWAVE MATERIALS AND THEIR APPLICATIONS

JG|U

12th International **Conference** on **Microwave Materials and their Applications**

Call for Papers

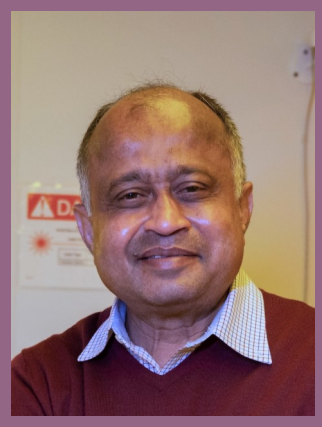
Abstract submission open until June 15, 2023 **Register under http://mma2023.uni-mainz.de**

Keynote Speakers

Malgorzata Celuch

President QWED, Warsaw, Poland

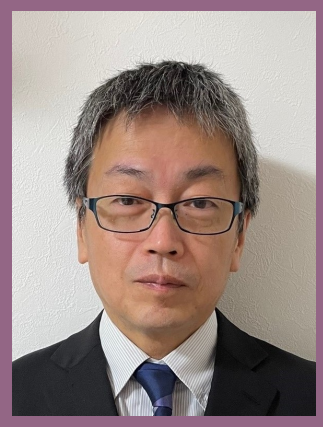
Recent Developments and Cross-Calibration of Resonator-Based Techniques for Microwave and mmWave Materials Assessment



Madhavan Swaminathan

Dept. Head Electrical Engineering,
Director, CHIMES (an SRC JUMP 2.0 Center)
Penn State University, PA, USA

Packaging Materials for Advanced Computing and Communications - Challenges and Opportunities



Yasutaka Sugimoto

Principal Researcher RF development,
Murata Manufacturing, Kyoto, Japan

LTCC materials and their processes for wireless communications

Conference Topics

- LTCC / ULTCC
- 5G/6G telecommunication
- Material aspects of packaging
- Advances in modelling and characterization
- Microwave and Millimeter-wave materials
- Applications and passive components
- Advances in processing and design
- Green and sustainable materials

Organizers

Martin Letz, SCHOTT AG Mainz
Jure Demsar, JGU Mainz

For further questions and industry exhibition contact:

mma2023@uni-mainz.de

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Paper ID 5552

Development and possible applications of tunable elements based on composite materials

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The composite materials and elements based on them are of significant scientific and practical interest because they allow properties that are difficult or impossible to achieve in single-phase systems to be realized. For the preparation of composite materials and elements based on them for various electrical devices, oxide magnetic materials are often used in the form of weakly agglomerated nanoparticles

The work shows the conditions for the preparation of weakly agglomerated nanoparticles of magnetic materials with different crystal structures. It has been established that by changing the synthesis conditions from solutions, it is possible to control the fractal structure of the precipitate and influence the shape of the nanoparticles. Using synthesized magnetic nanoparticles, various nonlinear elements have been developed, including:

1. *Nonlinear resonant microwave elements* included a high-quality dielectric resonator with a composite magnetic film based on a photopolymer and weakly agglomerated magnetic nanoparticles deposited on it. It has been established that the experimentally determined nonlinear characteristics of the composite resonant element exceed the calculated data. This can be explained by the fact that the dielectric material concentrates the magnetic field in the film and provides high nonlinearity. Composite dielectric resonators can be used in the development of nonlinear microwave devices. It has also been shown that the use of high-quality dielectric resonators due to the energy concentration can increase EPR sensitivity by 5-10 times, which allows small amounts of test material to be used in experiments. This can be important in biomedical research.
2. *Left-handed media* are characterized in the microwave range by simultaneously negative magnetic permeability and dielectric constant. Such media have been successfully implemented based on magnetic oxide systems with a perovskite structure, which exhibits a metallic character of conductivity. Similar systems can be used in the development of multifunctional microwave devices.
3. *Nonlinear magneto-electric systems* with controlled phase transition temperature in a magnetic film by an electric field based on a semiconductor ferroelectric with electronic conductivity and a magnetic oxide film with a perovskite structure and hole conductivity. In these structures, ferroelectric and ferromagnetic properties of components in composite structures can be related through volume charge at boundaries between ferroelectric and magnetic phases and PTCR effect in the ferroelectric phase.

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