About V. I. Vernadsky IGIC NASU

The V.I. Vernadsky Institute of General and Inorganic Chemistry was founded in 1918 by Academician V.I. Vernadsky. It was originally a Chemical Laboratory in Kyiv and later joined with the research department of chemistry at the Kyiv Polytechnic Institute. In 1929, it became the Research Institute of Chemistry and in 1931, it joined the Ukrainian SSR Academy of Sciences as the Institute of Chemistry. It was renamed the Institute of General and Inorganic Chemistry in 1945 and received its current name in 1993.

The Institute has founded five chemical institutions and is now a state nonprofit institution and the main scientific center for fundamental and applied research in various fields of chemistry. It actively cooperates with domestic and foreign universities, academic institutions, research centers, and industrial associations.

Today, the main practical purpose of the scientific activity of V.I. Vernadsky IGIC of the NAS of Ukraine is the creation of highly efficient, environmentally friendly, energy- and resource-saving technologies, including the inclusion of the secondary raw material in the production process, which will contribute to reducing the man-caused environmental impact.

Aim of V. I. Vernadsky IGIC NASU in the project:

the synthesis of new microwave materials with permittivity from 10 to 150 and varied dielectric quality factor Q which are needed to create resonator rectenna for energy harvesting and electromagnetic sensing, study their dielectric properties, and develops ways to control the dielectric properties in order to best match the design requirements for the created metamaterials.

Deliverables of V. I. Vernadsky IGIC NASU in the project:

- microwave dielectrics with Q_{10GHz} ~ 5000-7000 based on multiphase systems with the volumetric thermal compensation effect.
- microwave dielectrics based on a mixture of perovskite and spinel phases with Q_{10GHz} ~ 10000
- Optimization of parameters of microwave dielectric resonators prototypes.

V. I. Vernadsky IGIC NASU team

Anatolii Belous
Academician of NAS of Ukraine, Professor Doctor of Chemical Sciences, PPCD

Coordinating team members' research, analyzing results, and discussing them with partners

Oleg V'yunov,
Senior scientist,
Ph.D,
senior researcher

Investigation of crystal structure, phase formation and ceramic properties

Tetiana Plutenko,
Ph.D,
researcher

Synthesis and sintering of ceramic samples

Oleksandr Fedorchuk,
Ph.D,
researcher

Stipendiary,
characterization of dielectric parameters of ceramic samples

Pavlo Torchyniuk,
Ph.D,
researcher

Stipendiary,
synthesis and sintering of ceramic samples

V. I. Vernadsky IGIC NASU, additional specialists involved in the execution of the project

Solopan Serhii,
Senior researcher,
Dr.Sc.,
senior researcher

Kovalenko Leonid,
Ph.D,
senior researcher

Some equipment for synthesis of MW dielectric materials

Analytical scales for weighing the initial reagents and equipment for synthesis

Drums and layers for
planetary mill PM-100

Equipment for deposition of thin films and electrodes
(a) VUP-5; (b) SC7620 and CA7625

Tube furnace for rapid heating
GSL-1500X-RTP50

High-temperature furnace
KSL-1500X

Some equipment for mechanical preparation of MW dielectric materials

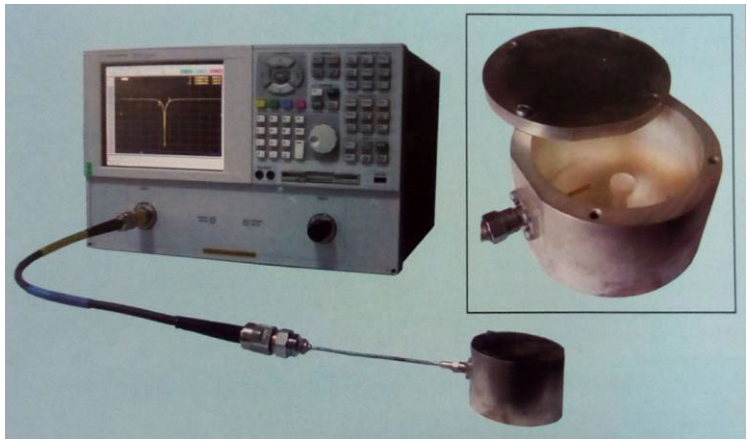
Sanding and polishing machine with automatic pneumatic head Forcimat & Forcimol 1V

Equipment for diamond cutting

Some equipment for investigation of MW dielectric materials

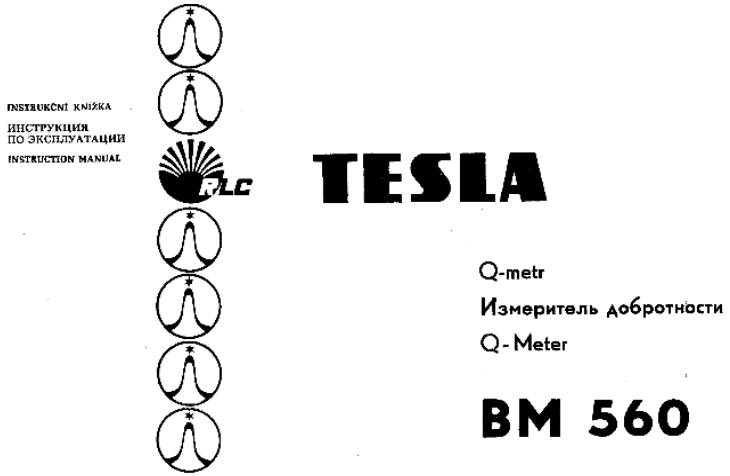
Electron microscope SNE-4500M

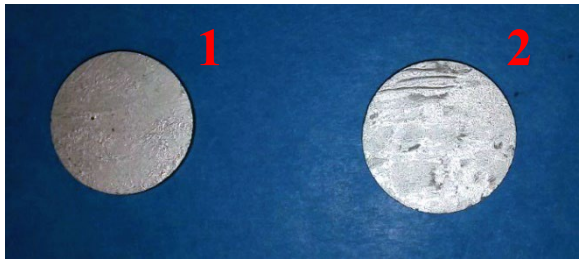
Experimental setup for impedance analysis



Setup for analysis of MW dielectrics Agilent N5230A

Measurement of dielectric parameters in the radio frequency range

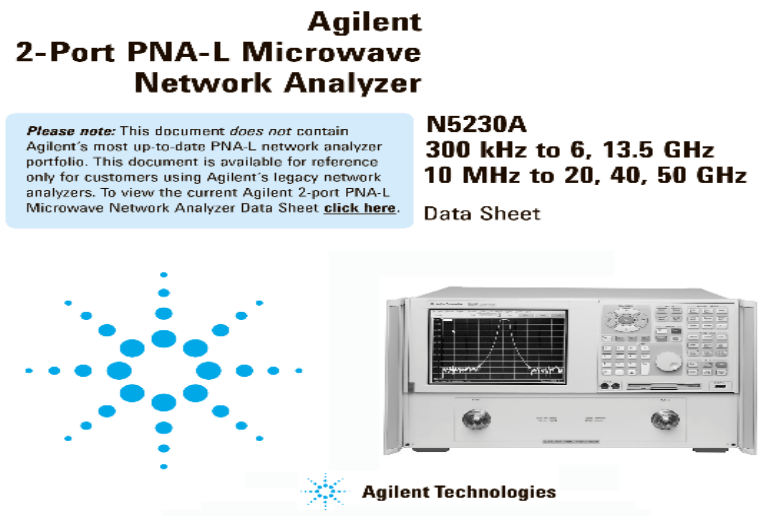




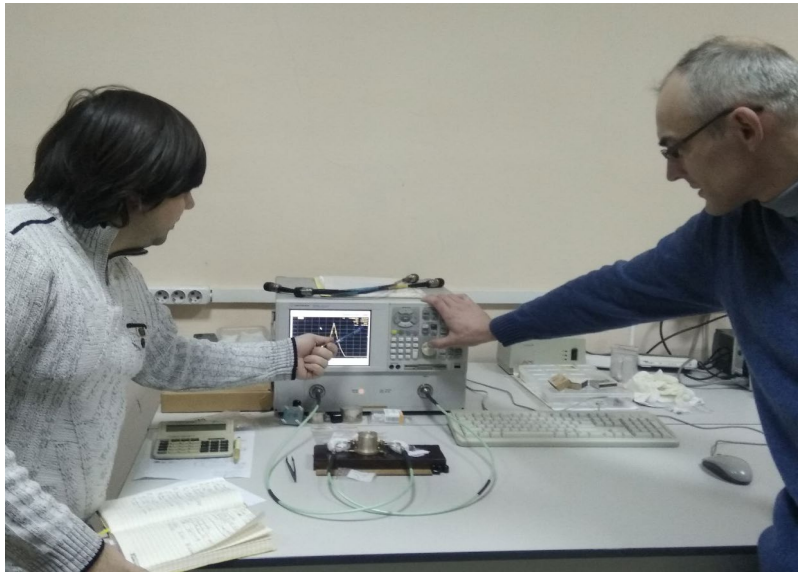
Experimental dielectric samples with permittivity of ~17 (1) and ~33 (2) for measurement in the radio frequency range.

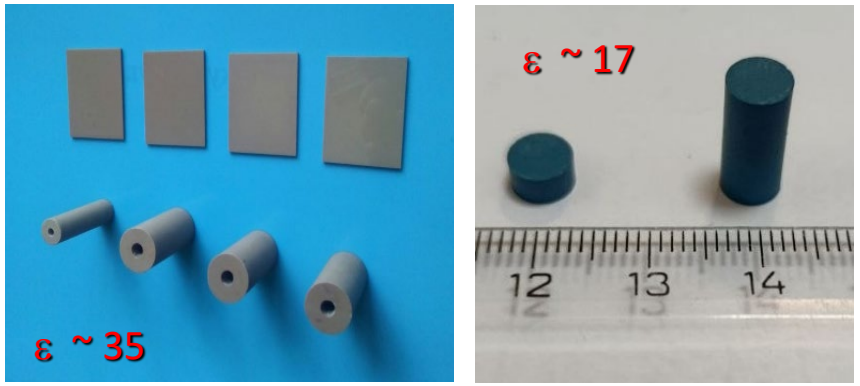
Sample type	Dia-meter, mm	Thick-ness, mm	Permit-tivity (ε)	Dielectric losses (tan δ)
1	16.201(4)	1.520(4)	17.7(8)	0.0010(3)
2	16.996(4)	1.480(4)	33.6(2)	0.0010(3)

Measurement of dielectric parameters in the microwave range



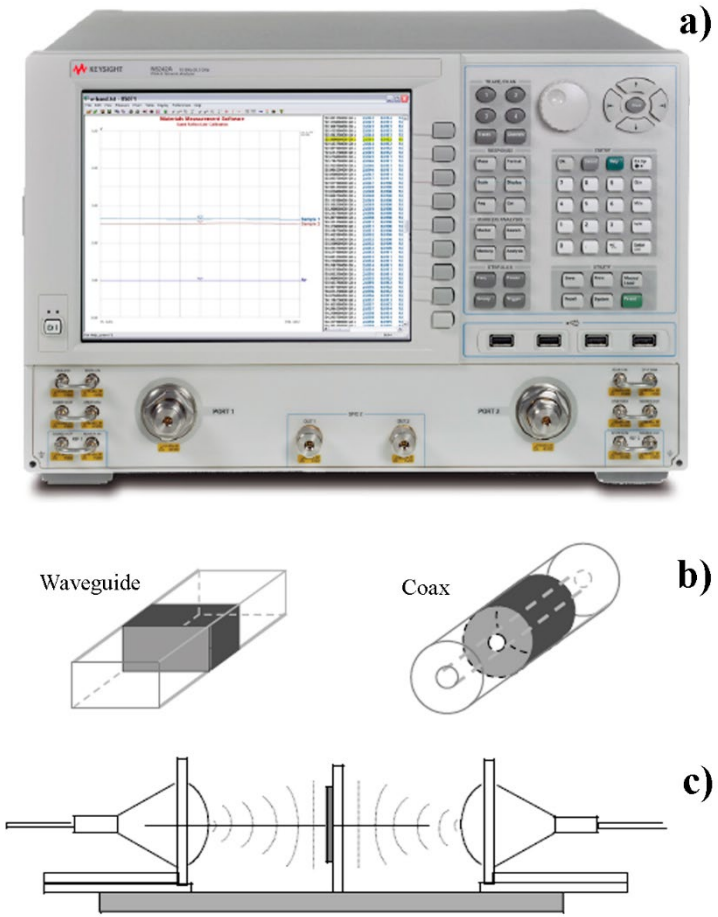
QWED, Warsaw, Poland





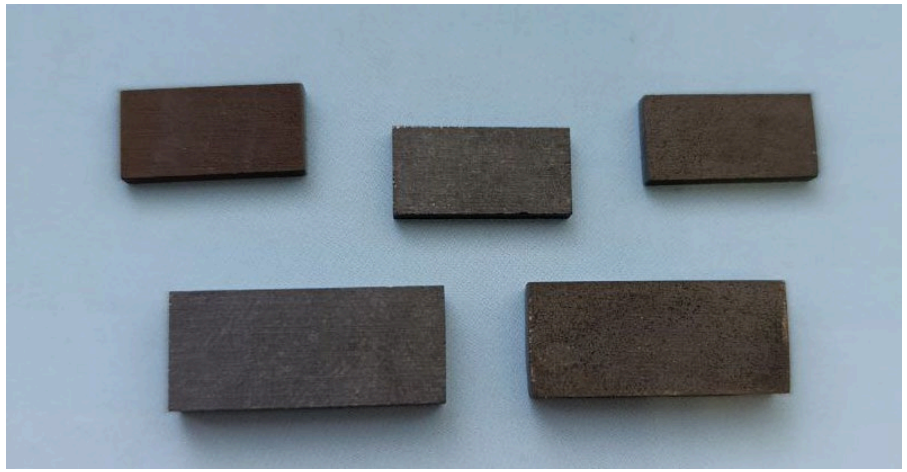
Samples characterized in the radio frequency and microwave ranges

Measurement of radio-absorbing materials



Microwave vector network analyzer (a), measurement in a rectangular metal waveguide and coaxial transmission line (b), and in free space (c).

For investigating of MW characteristics of radio-absorbing materials, three approaches can be used: measurements in a waveguide, in a coaxial line, and in free space.



Samples used to investigate the microwave characteristics of radio-absorbing materials in a waveguide. They must be prepared with geometric dimensions and shapes that exactly correspond to the internal parameters of the waveguide, as any gaps or irregularities reduce measurement accuracy.