

FIFTY YEARS OF EXCELLENCE

**21st Annual Conference YUCOMAT 2019 & 11th World Round Table
Conference on Sintering WRTCS 2019**

Herceg-Novi, September 2-6, 2019

**Prof. Dr. Dragan Uskoković, President of Materials Research Society of
Serbia and the International Institute for the Science of Sintering**

From September 2-6, 2019 in Herceg-Novi an international elite of scientists working in the field of advance materials, nanotechnologies and sintering gathered for the twenty-first Annual YUCOMAT 2019 Conference and the eleventh World Conference on Sintering WRTCS 2019. Exactly fifty years ago, in 1969, the First World Conference on Sintering was held in Herceg-Novi, and in 1995 the First Conference of the Materials Research Society of Serbia was also held in Herceg-Novi. This was the first that the two conferences were organized together.

As in previous years, this year's conferences were well attended. From year to year, there is a slight but continuous increase in the number of participants, which has risen to 170 this year. Thirty-two invited papers were presented by eminent experts from the world's most famous research centers, seventy regular papers were presented orally and also seventy papers were presented in the form of posters. The authors came from more than 30 different countries, and as in the previous years, 80 % of the papers were from authors from foreign laboratories, while the rest were papers by domestic authors, or as the result of joint research by domestic authors and colleagues from abroad.



At the Opening Ceremony, which was held on the first day of the conference, on September 2nd, the participants were first greeted by the President of the International Institute for the Science of Sintering and the Materials Research Society of Serbia, who presented on the importance of these two scientific conferences in the context of the community outreach and the dissemination of scientific excellence. The participants were also welcomed by the Chairman of the International Advisory Board of the Materials Research Society of Serbia, Robert Sinclair of Stanford University, who spoke about the continued rise of YUCOMAT conferences.

This year's winner of the 2019 MRS-Serbia Award for the Lasting and Outstanding Contribution to Materials Science and Engineering was Dr. Danilo Suvorov of the Jožef Stefan Institute of Ljubljana, Slovenia, for his research and practical achievements in the field of microwave ceramic materials for wireless applications. This was also the last award for which only scientists from former Yugoslav countries were eligible, including those who work in foreign laboratories, but originate from these regions. From the next year, 2020, the Award is fully open and internationalized to all the members of the Society, provided that the candidate must have made a significant contribution to the interests and goals of the Materials Research Society of Serbia.



The laureate of the 2019 MRS-Serbia Award for a Lasting and Outstanding Contribution to Materials Science and Engineering is Dr. Danilo Suvorov of the Jožef Stefan Institute from Ljubljana, Slovenia.

As in previous years, the First Plenary Session was the most outstanding, with five of its speakers attending YUCOMAT for the first time, and all the lectures having been devoted to the most current issues of nanoscience and nanomaterials for electronics and energy. First, stable perovskite structure solar cells with the highest conversion rate to date, 23 %, based on methylammonium lead iodide, developed at Lausanne EPFL, were discussed, with an emphasis on designing the chemical composition and the interfaces.



Dr. Mohammad Khaja Nazeeruddin was the first Plenary speaker this year on the topic: "Stable perovskite solar cells by compositional and interface engineering"

Then there was a discussion about synthesis, properties and application of graphene, boron nitride and similar 2D materials that mark an enormous and very rapid progress for practical applications in optoelectronic and electronic devices. A lecture on the functionality and versatility of metal oxide properties with a focus on transparent amorphous semiconductor oxides was also presented.

Nanomaterials in medicine were the subject of the Second Plenary Session, which began with a talk on optimizing the properties of gold nanoparticles for the early diagnosis of cancer cells using high resolution characterization methods. This was followed by the design of new pharmaceutical drug release systems for combination therapies of special cancer cells resistant to conventional drugs. Next in the line was a talk on the synthesis and administration of megamolecules and aerosol nanoparticle synthesis, which is used today for the mass production of titanium-dioxide, silicon-dioxide, carbon materials and a large number of different nanoparticles for special applications.

The formation of complete hospital units using sonochemical coatings with antibacterial particles, hybrid nanoparticles and their applications in nanomedicine was also discussed as well as the design of composite nanoparticles, so-called earthicles, for the penetration of the blood-brain barrier and brain tumor targeting.

The third plenary session considered a new approach for heterostructured materials with superior mechanical properties, using intensive plastic deformation. It also included a talk on optimizing the properties of titanium alloys using "three-dimensional printing" and obtaining new materials for sustainable technologies by hybridizing carbohydrates with metal oxides under the influence of intense mechanical stress.

Nanostructured materials for electrocatalytic processes in energy, computer modeling in materials science and catalysis, special phase crystal chemistry, and high-resolution methods for characterization of new materials were presented at the fourth plenary session by the Diamond Sponsor of the Conference.

Two plenary sessions about sintering discussed the most actual problems in this area, starting with classical modeling and micromechanics at the particle level, which contained experimental and numerical studies of microstructure development during sintering with and without the action of external forces. Discussed were also the fundamental aspects of multiphase disordered high-entropy alloys sintering, and the session ended with the production of non-porous sintering materials, with a special emphasis on a specific class of transparent oxide systems that have four times better mechanical impact properties than the existing "gorilla" glasses used in the screens of "smart" phones and tablets. Within these sessions, it was also talked about obtaining electroceramics at room temperature without sintering.



170 participants presented their work at the twenty-first Annual YUCOMAT 2019 Conference and the eleventh World Conference on Sintering WRTCS 2019

Considering the large number of papers that were presented by the eminent foreign and domestic authors, the diversity of topics broadly covered the most current areas of new materials and nanotechnologies as well as a number of related materials science disciplines, YUCOMAT 2019 and the 11th World Conference on Sintering have again been confirmed as the one of most significant events in this field, which distinguished scientists from all over the world gladly attend and return to.

Next Annual Conference, YUCOMAT 2020, will be held from September 7–11, 2020, [Herceg Novi](#), when we will mark the 25th anniversary since the first YUCOMAT Conference was held 1995. The first [list of Confirmed Plenary speakers](#) is already on our [website](#).

This year, at the Closing Ceremony, YUCOMAT & WRTCS 2019 awards went to:

1. Saide Umerova, "**Screen-printed thin smooth nanostructured BaTiO₃ films for printed electronics**" (Frantsevich Institute for Problems of Materials Science of NASU, Kiev, Ukraine) for the best oral presentation.
2. Sabina Horodecka, "**Ultra-fast volume-responsive temperature- and pH-sensitive poly(N-isopropylacrylamide) hydrogels**" (Institute of Macromolecular Chemistry, Czech Academy of Sciences, Heyrovského nám.2,Praha, Czech Republic) for the best poster presentation.
3. Alexander V. Bakulin,"**Influence of the impurity segregation on the adhesion properties of Al₂O₃/Ti₃Al interface**", (Institute of Strength Physics and Materials Science SB RAS,Tomsk, Russia) for the best poster presentation.
4. Daniel M. Mijailović, "**High-performance supercapacitors based on core-shell structured carbon fibers@spinel oxide composites**" (University of Belgrade, Innovation Center, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120, Belgrade, Serbia) for the best poster presentation.

LIST OF PLENARY LECTURES

YUCOMAT 2019

Mohammed K. Nazeeruddin, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
STABLE PEROVSKITE SOLAR CELLS BY COMPOSITIONAL AND INTERFACE ENGINEERING

Andrea C. Ferrari, Cambridge Graphene Centre, Engineering Department, University of Cambridge, Cambridge, UK
GRAPHENE AND RELATED MATERIALS, FROM PRODUCTION TO APPLICATIONS

Sir Colin Humphreys, Department of Materials Science and Metallurgy, University of Cambridge United Kingdom
NEXT-GENERATION LARGE-AREA GRAPHENE FOR ELECTRONIC DEVICES

Elvira Maria Correia Fortunato, Universidade NOVA de Lisboa, CENIMAT, Caparica, Portugal
FUNCTIONALITY AND VERSATILITY OF METAL OXIDES

Yoshio Bando, Institute of Molecular Plus, Tianjin University P. R. China
BORON NITRIDE NANOTUBE/NANOSHEET FOR ENERGY APPLICATIONS

Rafal Dunin-Borkowski, Institute for Microstructure Research, Forschungszentrum, Jülich, Germany
MODEL-BASED CHARACTERISATION OF MAGNETIC MOMENTS AND CHARGE DENSITIES IN THE TRANSMISSION ELECTRON MICROSCOPE

Robert Sinclair, Materials Science and Engineering Department, Stanford University, Stanford, CA, USA
USING STEM-EELS TO OPTIMIZE GOLD NANOPARTICLES FOR EARLY CANCER DETECTION

Vladimir Torchilin, Center for Pharmaceutical Biotechnology & Nanomedicine, Northeastern University, Boston, MA, USA
ENGINEERING OF NOVEL PHARMACEUTICAL DRUG DELIVERY SYSTEMS FOR COMBINATION THERAPY OF MULTIDRUG RESISTANT CANCER

Milan Mrksich, McCormick School of Engineering, Northwestern University, Evanston, Illinois, USA
SYNTHESIS AND APPLICATIONS OF MEGAMOLECULES

Sotiris Pratsinis, Department of Mechanical and Process Engineering, Federal Institute of Technology Zurich, Switzerland
COMBUSTION SPRAY SYNTHESIS OF NANOSTRUCTURED MATERIALS: FROM CARBON BLACK TO BREATH SENSORS

Aharon Gedanken, Department of Chemistry, Bar-Ilan University, Ramat-Gan, Israel
MAKING THE HOSPITAL A SAFER PLACE BY THE SONOCHEMICAL COATING OF ALL IT TEXTILES AND MEDICAL DEVICES WITH ANTIBACTERIAL NANOPARTICLES

Vuk Uskoković, Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA, USA

EARTHICLE AND ITS DISCONTENTS

Yuntian T. Zhu, Materials Science & Engineering, North Carolina State University, Raleigh, USA
HETEROSTRUCTURED MATERIALS: A NEW PARADIGM FOR SUPERIOR MECHANICAL PROPERTIES

Hamish L. Fraser, Department of Materials Science and Engineering, Center for Accelerated Maturation of Materials, Columbus, Ohio, USA

OPTIMIZING THE PROPERTIES OF TITANIUM ALLOYS PROCESSED USING ADDITIVE MANUFACTURING

Mamoru Senna, Department of Applied Chemistry, Keio University, Yokohama, Japan
HYBRIDIZATION OF SOLID CARBOHYDRATES OR HYDROCARBON WITH METAL OXIDES UNDER MECHANICAL STRESSING TOWARD SUSTAINABLE MATERIALS

Shizhang Qiao, School of Chemical Engineering, The University of Adelaide, Australia

NANOSTRUCTURED MATERIALS FOR ENERGY-RELEVANT ELECTROCATALYTIC PROCESSES

Richard Catlow, Department of Chemistry, University College London, UK

COMPUTER MODELLING AS A PREDICTIVE TOOL IN MATERIALS AND CATALYTIC SCIENCE

Peter Franz Rogl, Institute of Physical Chemistry, University of Vienna, Austria

CRYSTAL CHEMISTRY AND PROPERTIES OF G-PHASES

Dae Hong Ko, Department of Materials Science and Engineering, YONSEI University, Seoul, Korea
STRAIN-ENGINEERING IN ADVANCED CMOS STRUCTURES

Nobuo Tanaka, Institute for Materials and Systems for Sustainability (IMaSS), Nagoya University, Japan
ENVIRONMENTAL TEM STUDY OF ADVANCED NANO-MATERIALS

WRTCS 2019

Eugene E. Olevsky, College of Engineering, San Diego State University, San Diego, CA, USA
CHALLENGES AND FURTHER DEVELOPMENTS IN MODELLING OF SINTERING

Fumihiko Wakai, Laboratory for Materials & Structures, Tokyo Institute of Technology, Japan
MICROMECHANICS OF SINTERING IN PARTICLE SCALE

Rajendra K. Bordia, Department of Materials Science and Engineering, Clemson University, Clemson, SC, USA
COUPLED EXPERIMENTAL AND NUMERICAL INVESTIGATION OF EVOLUTION OF ANISOTROPIC MICROSTRUCTURES DURING STRESS-ASSISTED AND CONSTRAINED SINTERING

Bernd Kieback, Institute of Materials Science, Dresden University of Technology, Dresden, Germany
FUNDAMENTALS OF SOLID STATE SINTERING IN MULTICOMPONENT HIGH ENTROPY ALLOYS

Suk-Joong L. Kang, Korea Advanced Institute for the Science & Technology, Seoul, Korea
WHAT WE SHOULD CONSIDER FOR FULL DENSIFICATION WHEN SINTERING

Martin Bram, Forschungszentrum Julich, 52425 Julich, Germany
INCREASE OF FRACTURE TOUGHNESS OF TRANSPARENT CERAMICS BY FUNCTIONAL, LOW THERMAL-EXPANSION COATINGS

Heli Jantunen, Faculty of Information Technology and Electrical Engineering, University of Oulu, Finland
ELECTROCERAMICS WITHOUT SINTERING

Wayne D. Kaplan, Israel Institute of Technology, Technion City, Haifa, Israel
THE MECHANISMS BEHIND SOLUTE-DRAW AND SOLUTE-ACCELERATION DURING MICROSTRUCTURAL EVOLUTION OF ALUMINA

Andrey V Ragulya, Frantsevich Institute for Problems of Materials, Kiyv, Ukraine
UNDERSTANDING OF SINTERING IN UKRAINE: OVERVIEW OF RESULTS

Invited Diamond Sponsor Lecture

Maarten Wirix, Thermo Fisher Scientific, Eindhoven, Netherlands
INTERGRATED DIFFERENTIAL PHASE CONTRAST (iDPC) STEM FOR LOW Z DETECTION AND FOR HIGH CONTRAST LOW DOSE IMAGING APPLICATIONS