

Conference Report: YUCOMAT 2022 & XII World Round Table Conference on Sintering [†]

Vuk Uskoković ^{1,2} 

¹ Advanced Materials and Nanobiotechnology Laboratory, TardigradeNano, Irvine, CA 92604, USA; vuk.uskokovic@tardigradenano.com

² Department of Mechanical Engineering, San Diego State University, San Diego, CA 92182, USA

[†] YUCOMAT 2022 & XII World Round Table Conference on Sintering, Herceg-Novi, Montenegro, 29 August–2 September 2022.

Abstract: Yugoslav Conference on Materials (YUCOMAT) and World Round Table Conference on Sintering (WRTCS) are conferences with a long tradition, having first been held in 1995 and 1969, respectively. From 29 August to 2 September 2022, the Materials Research Society of Serbia (MRS-Serbia) and the International Institute for the Science of Sintering organized the two conferences jointly, in the town in which they had been inaugurally held: Herceg-Novi, Montenegro. The joint conference attracted around 200 participants, 20 of which were plenary speakers, while the rest were assigned regular oral or poster presentations. The participants came from 25 different countries of the world, the most represented among which were Serbia, Ukraine, Czech Republic, Poland, and the United States. Outside of the four plenary sessions at YUCOMAT and two at the WRTCS, the conference was divided to five symposia: (i) advanced methods in synthesis and processing of materials; (ii) advanced materials for high-technology applications; (iii) nanostructured materials; (iv) eco-materials and eco-technologies; and (v) biomaterials. Here, one of this year's plenary lecturers at YUCOMAT and a member of the International Advisory Board for the MRS-Serbia gives a formally solicited and unbiased view of the conference, discussing its successful aspects and aspects worth revisiting, alongside providing a few historical remarks.

Keywords: biomaterials; international conference; materials science; MRS-Serbia; nanostructured materials; sintering



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1. Introduction

The 23rd YUCOMAT conference was held from 29 August to 2 September 2022 in Herceg-Novi, Montenegro [1]. The hybrid conference was organized jointly with the 12th World Round Table Conference on Sintering (WRTCS). It attracted around 200 participants (Figures 1 and 2), 20 of which were plenary speakers, while the rest were assigned regular oral or poster presentations. Outside of the four plenary sessions at YUCOMAT and two at the WRTCS, the conference was divided to five symposia: (i) advanced methods in synthesis and processing of materials; (ii) advanced materials for high-technology applications; (iii) nanostructured materials; (iv) eco-materials and eco-technologies; and (v) biomaterials. The majority of the presentations were conducted live, in the main and the small lecture halls inside the Herceg-Novi Sun Resort venue, a stone's throw away from the scenic Adriatic shore, and only five were held virtually, via prerecorded lectures played to the viewers in the lecture hall.

Naturally, given that YUCOMAT is being organized by the Materials Research Society of Serbia (MRS-Serbia) and the WRTCS by the International Institute for the Science of Sintering (IISS), the two associations presided over by the renowned Montenegrin-born Serbian materials scientist, Dragan Uskoković, the majority of participants came from Serbia, approximately 25%. The second biggest contributor of participants was Ukraine

at around 15%, largely thanks to the generous support provided by MRS-Serbia, Drexel University and the United States Air Force Office of Scientific Research based in London, UK. This was followed by contributors from the Czech Republic, then Poland, United States, Republic of Korea, Turkey, Montenegro, Germany, Switzerland, Latvia, Slovenia, Austria, United Kingdom, Slovakia, Japan, Romania, Belgium, Bulgaria, Croatia, Bosnia and Herzegovina, Hungary, Finland, Portugal, and Spain.



Figure 1. Collective photo of the conference participants taken on the first day of the conference.



Figure 2. Main lecture hall during the opening ceremony address by Dragan Uskoković, President of MRS-Serbia and President of the Managing Board of IISS (a) and during the plenary lecture by Richard Siegel (b). Seated at the desk in (a) are, from left to right, Bojana Obradović, Chair of the YUCOMAT Awards Committee, Dejan Raković, Vice-President of MRS-Serbia, Yuri Gogotsi, Chair of the International Advisory Board at MRS-Serbia, Robert Sinclair, Honorary Chair of the International Advisory Board at MRS-Serbia, and Velimir Radmilović, Vice-President of MRS-Serbia.

The history of YUCOMAT dates back to 1995, when the first of this series of conferences was held in a country ravaged by war, with not a single foreign participant. The country, back then, was still named Yugoslavia, and this name ended up being incorporated in the acronym of the conference, which stands for the YUGoslav Conference on MATerials.

Today, of course, Yugoslavia is no more, yet the title of the meeting has remained, offering a hint at a past that seems exotic to many of today's foreign participants, connoting a union of different cultures, languages, religions and ethnicities.

Scientists in Yugoslavia almost unanimously take pride in their standing during the Cold War era between the two fires, as it were, offering opportunities, including via conferences, for scholars separated by the Iron Curtain to meet and discuss science free from the oppressive binds of politics [2]. WRTCS conferences were exactly such middle grounds where scientists from the United States or western Europe could discuss science and form friendly ties with their colleagues from the Eastern Bloc or the Non-Aligned Movement. This tradition continues to live, 53 years after the first WRTCS was organized and 27 years after the first YUCOMAT was held, both in the very same coastal town of Herceg-Novi.

2. Conference Highlights

A definite highlight of this year's YUCOMAT was the participation of Andre Geim (Figure 3a), who won the Nobel Prize in Physics in 2010 for his studies on graphene. The notions of simplicity and serendipity were not discussed in Andre's lecture, which many may have expected by knowing the story of how graphene had first been obtained: by peeling flakes of graphite with the scotch tape. Rather, Andre's talk was on "two-dimensional emptiness" [3], specifically on curious and counterintuitive effects produced by extracting single atomic planes from bulk crystals. Interestingly, in a materials science world busying itself with the creation and testing of any of the innumerable possible 2D atomic architectures, the Nobel Prize winner from the University of Manchester demonstrated a work in the opposite direction, namely that of extracting 2D defects from bulk crystals, giving a clue to those who know how to read between the lines of subtext as to how an inventive mind works—always against the stream of fashion in the field [4].



Figure 3. Andre Geim, the 2010 Nobel Laureate in Physics, preparing to deliver the plenary lecture (a) and Richard Siegel receiving the award for the lasting and outstanding contribution to materials science and engineering (b). Yuri Gogotsi, Chair of the International Advisory Board at MRS-Serbia, Richard Siegel, Member of the International Advisory Board at MRS-Serbia, Pam Siegel, and Dragan Uskoković, President of MRS-Serbia and President of the Managing Board of IISS [from left to right in (b)].

Another memorable moment was the lecture by Richard Siegel of Rensselaer Polytechnic, the recipient of this year's award for the lasting and outstanding contribution to materials science and engineering (Figure 3b). His talk was an amusing ride through an exhaustive career in materials science, covering both academic and industrial achievements, which the deliverer compared to a safari, with a camera and a gun—electron, mind you—on his back [5]. Fantastic achievements in high-resolution imaging, including the ability

to map the electric field and charge density of materials with sub-angstrom resolution, emerged from the lecture by Xiaoqing Pan from University of California in Irvine [6]. Compared to YUCOMATs in the 2010s, which were dominated by state-of-the-art reports on similar advances in high-resolution imaging, 2D materials appeared to have been at the forefront of this year's conference, with notable presentations on this topic being given by Pulickel Ajayan from Rice University on hybrid architectures obtained by stacking 2D atomic layers [7] (Figure 4a), by Marija Drndić from the University of Pennsylvania on the production of 2D nanopores for controlled perturbation of ion current flows [8], and by Yuri Gogotsi from Drexel University on 2D carbides and nitrides of early transition metals also known as MXenes [9].



Figure 4. Plenary talks by Pulickel Ajayan (a), Gerda Rogl (b), Horst Hahn, Member of the International Advisory Board at MRS-Serbia (c), Vuk Uskoković, the author and Member of the International Advisory Board at MRS-Serbia (d), Suk-Joong Kang, Member of the Managing Board at IISS (e), Hamish Fraser, Member of the International Advisory Board at MRS-Serbia (f), Sotiris Pratsinis (g), and Ana Senos (h). Biljana Stojanović, IISS Conference Co-Chair for Serbia, is seen in the far right in (h).

Thermoelectrics and triboelectrics received their highlights in the lectures by Peter and Gerda Rogl from the Vienna University [10,11] (Figure 4b) and by Zhong Lin Wang from the Georgia Institute of Technology and the Chinese Academy of Sciences [12], respectively. Despite the virtual lecture held by the latter and a rather dreary recording, his being a scientist with the 10th highest h-index in the world was sufficient to attract a decent crowd to the hall. Another virtual lecture was by Ivan Božović from the Brookhaven National Lab, which was on challenges entailing the measurements of electronic nematicity in superconducting cuprates and other materials with correlated electrons [13].

Soft materials and crystal growth phenomena are traditionally meagerly represented at YUCOMAT conferences and this year's key contribution to the latter topic came in the form of a lecture by Horst Hahn from the Karlsruhe Institute of Technology, who described methods for the fabrication of materials starting from atomic clusters [14] (Figure 4c). In a private conversation during one of many coffee hours, he asserted his hope that this method could be used to create amorphous materials with an even lower energy state than that of the most stable current configurations, which may be interesting for various applications for such non-equilibrium structures.

The biomaterials section was represented well, most notably by the various research groups from the Faculty of Technology and Metallurgy at University of Belgrade, but also by other European research centers, including, most prominently, Brno University of Technology from the Czech Republic and Sumy State University from Ukraine. Alongside that, Robert Sinclair from Stanford University reported on a method to measure the concentrations of abnormal mineral deposits in the brains of patients with Alzheimer's disease [15], whereas Vladimir Torchilin from the Northeastern University lectured on the use of P-glycoprotein as an efflux pump controller whose co-delivery with antibiotics might reverse the bacterial cell resistance to therapy and provided an update on the many properties that multifunctional stimuli-responsive nanocarriers in drug delivery should possess [16].

This author's modest contribution came in the form of a plenary lecture that happened to be the only one in the course of the conference to tackle the very actual topic of COVID-19 [17] (Figure 4d). In addition to providing information about the structural characteristics of SARS-CoV-2 relative to SARS-CoV-1 [18] and the role of nanotechnologies in curbing the pandemic [19,20], the talk aimed to inspire the audience to more frequently infuse materials science research with humanistic drives. This was exemplified by the case study on nano-vaccines against COVID-19, which showed the expansion of the gap between the rich and the poor by the products of nanomedicine [21]; by the author's organizing the first scientific collaboration between Serbian and Albanian scientists from Kosovo, 25 years after the Kosovo War [22]; by his pioneering a series of conceptually new forms of scientific paper as a literary genre, such that they blend inventive research with dramaturgical and other artistic elements [23–25]; by his advocating the materials science “of and for the poor” wherein the scarcity of resources acts as a driver of innovative thought [26–28]; and by his historical study on the configurational model of the Soviet materials scientist, G. V. Samsonov, from which detrimental effects of geopolitics on proliferation of scientific models could be inferred [29].

As far as the WRTCS portion of the conference was concerned, around 25 presentations were given in total, be it as plenaries, orals or posters. Notable lectures were given by Eugene Olevsky and Elisa Torresani from San Diego State University on additive manufacturing assisted with spark plasma sintering [30,31]; by Rajendra Bordia from Clemson University on the uses of machine learning in sintering of alumina [32]; by Suk-Joong Kang from the Korea Advanced Institute of Science and Technology on the importance of faceting and other elements of the surface crystal structure on sintering kinetics and mechanisms [33] (Figure 4e); by Hamish Fraser from the Ohio State University on the compositional control of the columnar-to-equiaxed transition in the grain morphology of Ti alloys produced by additive manufacturing [34] (Figure 4f); by Olivier Guillon from Aachen University on the uses of electric fields to assist the sintering of oxides [35]; by

Sotiris Pratsinis from the Swiss Federal Institute of Technology in Zurich on the application of sintering principles in the aerosol synthesis of nanostructured materials [36] (Figure 4g); by Ana Senos from the University of Aveiro on the flash sintering of potassium sodium niobates [37] (Figure 4h); and by Masaaki Aoki from the Keio University in Japan on the sintering of Ag bonding layers that enables SiC power chip operations with a high-power conversion [38].

Numerous talks from regular oral sessions stood out for their quality, including those by Stefan Popović from the National Institute of Chemistry in Slovenia on how electrochemical surface area determination methods, albeit deemed noninvasive, predispose materials to specific catalytic activity and selectivity [39]; by Alexander Vogel from the Swiss Federal Laboratories for Materials Science and Technology on the control of yttrium layer corrugations to tune ferroelectric polarization in multiferroic manganites [40]; by Patrick Gane from Aalto University in Finland on the use of nanofibrillated cellulose in selective mineral separation for circular economy [41]; by Ievgen Solodkyi from the Kiev Polytechnic Institute on reinforced composites employing high-entropy alloys [42]; by Radosław Bardo from the AGH University of Science and Technology in Poland on the control of homogeneity in high-entropy alloys fabricated by selective laser melting [43]; by Piotr Cyganik from the Smoluchowski Institute of Physics in Poland on odd-even packing density effects during the deposition of oligopeptide monolayers onto Au or Ag [44]; by Svetlana Yefimova from the National Academy of Sciences of Ukraine on the theranostic and dual, pro- and anti-oxidant action of (Gd,Y)VO₄:Eu³⁺ nanoparticles [45]; by Snežana Lazić from the Autonomous University of Madrid in Spain on the spectral tuning of quantum dots by radio frequency surface acoustic waves for future quantum information technologies [46]; and by many others.

When it comes to young presenters, a special committee awarded five oral and five poster presenters, along with one submitter of a PhD dissertation. Thanks to the support from the MRS-Serbia and the MRS-Singapore, the next year's conference fees for the winners will be waived should they decide to participate again. The poster sessions having taken place on three consecutive days, in fact, were immaculately organized, in the open air, near the shore, and in the early morning hours (Figures 5 and 6). This timing was unusual, but the participants were well rested and the chats about science were plentiful. The scenic setting ensured that many formal and informal contacts were made during the discussions revolving around the poster contents. Combined with numerous coffee hours, the lavish cocktail party on the opening night, a friendly and always helpful clique at the front desk (Figure 7) and the boat ride across the bay for the conference attendees on one of the afternoons (Figure 8), this provided for an enjoyable balance between the pleasure for the senses and the pleasure for the intellect.



Figure 5. Cont.



Figure 5. Poster sessions at the conference. The author on the far left in (a) discusses a poster on hierarchically porous polysaccharide anodes for supercapacitors with the presenter, Julien Lemieux from the Catholic University of Leuven in Belgium. Leonid Vasylechko from Lviv Polytechnic National University in Ukraine discusses the poster presented by Gennadii Kochetov from Kyiv National University of Construction and Architecture in Ukraine in (b). The author discusses 3D printed calcium phosphate scaffolds for the prevention of osteomyelitis with the poster presenter, Zuzana Kadlecová from the Brno University of Technology in (c). Yuri Gogotsi, Chair of the International Advisory Board at MRS-Serbia, discusses the poster presented by Katarina Kacvinská from the Brno University of Technology with Milica Stefanović, Marija Milivojević and Jelena Rakić from the University of Belgrade in Serbia in (d).

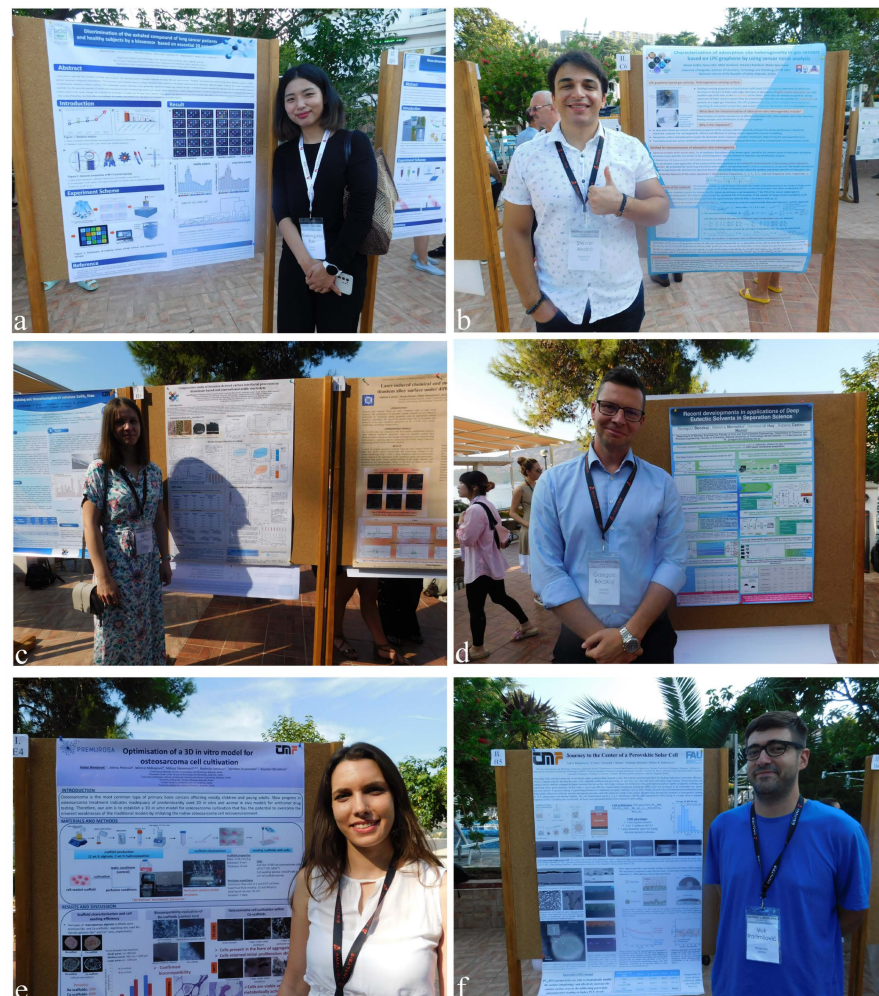


Figure 6. Cont.



Figure 6. Some, not all, of the posters that stood out for their quality were presented by Gyeong-Ha Bak from Pusan National University in South Korea on a bacteriophage-based breath sensor for the detection of lung cancer (a), Stevan Andrić from the Institute of Chemistry, Technology and Metallurgy in Serbia on the use of sensor noise to discern adsorption sites on graphene sheets (b), Jana Mišurović from the University of Montenegro on Al-ion charge storage in activated carbons (c), Grzegorz Boczkaj from the Gdansk University of Technology in Poland on deep eutectic solvents as separation materials (d), Ivana Banićević from the University of Belgrade in Serbia on hydrogel scaffolds from perfusion bioreactors (e), Vuk Radmilović from the University of Belgrade in Serbia on characterization of perovskite solar cells (f), Martina Štaffová from the Brno University of Technology in the Czech Republic on 3D printed auxetic structures (g), and Yuri Gogotsi, Chair of the International Advisory Board at MRS-Serbia, in lieu of Ivan Baginskiy from the Materials Research Center in Kyiv, Ukraine, on upscaling the manufacture of MXenes (h).



Figure 7. The conference front desk squad. Dušana Nedović, YUCOMAT Conference Manager, Zoran Jovanović, YUCOMAT Chairperson, Ivana Dinić, Member of the YUCOMAT Technical Committee, Marko Jelić, Member of the YUCOMAT Technical Committee, Sonja Jovanović, YUCOMAT Member, Željko Mravik, Member of the YUCOMAT Technical Committee, and Ivana Kovačević, YUCOMAT Conference Manager (from left to right).



Figure 8. Boat excursion for the conference participants through the Boka Kotorska Bay on the fourth day of the conference (a,b).

3. Critical Remarks

Based on private conversation with dozens of attendees, their satisfaction with the conference was unanimous. Notwithstanding the evident satisfaction of the participants and success of the conference, especially for small countries with a modest science scene such as Serbia or Montenegro, there are definite points that organizers may want to address in the effort to further improve its quality. For one, YUCOMAT has always been a type of conference more similar in scope and style to Gordon Research Conferences than to impersonal, corporate congresses run by massive scientific societies. To that end, the smallness of the meeting, allowing for everyone to meet everyone else in a comparatively informal setting conducive to a friendly dialog, is a greatest advantage of YUCOMAT [47]. For this to work, however, the plenary speakers should be encouraged to spend more time mingling with the young scientists than they currently do. It was a pleasure to see a scientist as remarkable as Yuri Gogotsi present a poster in lieu of a Ukrainian colleague who could not make it to the meeting (Figure 6h) when most scholars of his caliber would, sadly, not even dare thinking about attending a poster session. This exercise in humbleness, however, has become more of an exception than the rule, not only at YUCOMAT, but, based on this author's experience, at most scientific meetings worldwide as well. YUCOMAT as a meeting small in size, taking place in a part of the world known for its traditional resistance to imperialism of many kinds, presents a perfect venue for dispelling these airs of fake elitism surrounding science, but a conscious effort in that direction has been missing lately. For as long as a conference like this subsidizes the participation of distinguished speakers, the only effect producible will be that of an even deeper division between the so-called elite and the commoners, and a chance will be missed to contribute to building a more egalitarian model in science as a whole. It is discouraging that ours are times when small conferences must resort to financial assistance of renowned and reputable scientists, who are, as a rule, already in hold of sufficient funds to be able to support themselves to attend a meeting like this. In an ideal world, the incentives to visit the developing parts of the world and share knowledge with those who are deprived of conditions for research like those existing in the developed world should originate from scientists in these big and wealthy institutions, or else the organizers of small conferences are being forced to commit to a thankless task of taking from those who have not to give to those who have in abundance to maintain an adequate quality of the conference papers.

It needs to be understood that segregation along various professional hierarchies has reached critical proportions in materials science and science in general, and scientists occupying the tops of these hierarchies are the only ones to have a major influence and power to diminish this adverse trend, a process that starts with the demonstration of humbleness and will for a friendly talk with a fellow scientist, regardless of his/her status

or influence. That a Nobel laureate at this year's YUCOMAT, for one, could inspire a plethora of budding scientists with a story or two, but leaves them instead with the impression of a lofty and pretentious appearance is a failure on the human side of things, which blemishes any accolades earned in the sphere of science. Likewise, in the preceding years YUCOMAT evolved into a meeting where the impression was that the most notable speakers, whose work frequently revolved around high-resolution microscopy, participated mostly so as to get in touch and network with one another, thus forming closed circles impenetrable to a young scientist yearning for guidance from the experts in the field. When this is coupled to a state where annual awards are given to materials scientists who have shown nil interest to provide an impetus for the development of science and/or high-tech industry in Serbia and the neighboring region, questions could be raised if the choices for the awards have been appropriate. To shift the scene away from this neocolonial feel and closer to a state where everybody would feel equally accepted and equally relevant requires an active effort on behalf of the organizers of a meeting like this, who are invited on this occasion to deliberate over the right strategies to enable so. Concordantly, it is also advised that participation be enabled to scientists irrespective of their citizenships because materials science and people involved in it cannot be held responsible for the fallacies of governments of countries under whose flags they were born. Conferences like YUCOMAT are to be grounds where such superficial marks melt and commonalities among people are reached at deeper, more fundamental levels than those where petty politics abides. After all, if we were to assume, erroneously, that government politicians and their doings reflect people's sentiments about domestic and worldly affairs accurately, then there could be grounds to ban most everybody, this author included, from attending international meetings abroad.

One complain that has been aired by a notable former endower was that of a poor inclusion of women as scientists at YUCOMAT. Although this remark is valid at the plenary level where only 20% of presenters were women this year, it does not apply at all at the oral and the poster presentation levels, where 48.5% and 67.3% of the presenters, respectively, were women. This is not to say that an active effort in the promotion of materials science conducted by minorities is not needed; quite the opposite, a campaign reaching out to various disadvantaged research centers and communities would be a beneficial complement to the supposedly meritocratic campaign that exists today to attract some of the world-renowned speakers based on their influence, primarily on literature in the field, as assessed by citation numbers, Hirsch's and i10 indices, and others. Such simplistic criteria, of course, cannot measure the creativity and humanness of one's science and one's efforts surrounding science, such as through education, political engagements or public outreach. Additionally, such inflated citations in today's capitalist climate for scientific research are often reserved for prominent academic entrepreneurs and skilled solicitors of research funds [48], who have the liberty to acquire creative thinkers and hands-on workers with these funds to keep their labs efficient. For this reason, the expansion of these sheer bibliographic criteria into more humanistic territories is needed or else the conference will remain trapped on a Friedmanian terrain where the displays of any socially responsible actions pertaining to one's science are considered, erroneously, to be its dilutors rather than enrichers. Further, the connection with a local industry and roundtables giving out the impression that science presented at the conference could palpably benefit the local society has been lacking. In relation to that, nil local sponsors have supported the conference, which is in disparity with most other conferences of this type held abroad, in more developed regions of the world. On a more positive side of things, this lack of financial support has ensured that the conference continues to be in the hands of those who are in the business of organizing it for the love of materials science and the materials science community rather than those whose sole interest would be to profit from it.

4. Conclusions

To sum up, this year's YUCOMAT was a success, but a long and winding road is ahead of it; traveling across it is needed to ensure that YUCOMAT remains a conference small in size, but big at heart—a conference that will not lose its soul under the influence of various temptations that haunt modern science [49].

Next YUCOMAT is scheduled for 4–8 September 2023 (Figure 9).



Figure 9. Closing ceremony at YUCOMAT 2022 and XII WRTCS (a,b). Dragan Uskoković, President of MRS-Serbia and President of the Managing Board of IISS, addresses the audience and gives concluding remarks. Seated at the desk in (a) are, from left to right, Bojana Obradović, Chair of the YUCOMAT Awards Committee, Yuri Gogotsi, Chair of the International Advisory Board at MRS-Serbia, and Dejan Raković, Vice-President of MRS-Serbia. The author is seated under the rightmost half-moon wall sconce light in (b).

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