

Preface

The Proceedings PROGRES IN ADVANCED MATERIALS AND PROCESSES includes 93 papers presented at the Fifth Yugoslav Materials Research Society Conference (Yu-MRS Meeting) held in Herceg Novi, Yugoslavia, September 15-19th, 2003. Previous four Conferences were also held in Herceg Novi, when Yugoslav Materials Research Society was formed as non-government, non-profit, scientific association, whose main goals and tasks were the encourage creativity in materials science and engineering to achieve harmonic coordination of this field in our country and to connect it with analogous activities worldwide in order to include us into the global international programs. Materials science and engineering incorporate acquiring of the knowledge on materials synthesis and processing, their composition and structure, properties and behaviour and their functions and potentialities and its application to the devices, machines, units and other final products. Economic prosperity, quality of life and healthy environment are closely connected to improvement of existing and development of the new materials and processing technologies.

Few hundred scientists from our country and the world submitted 225 abstracts, of which 182 were presented. 147 registered participants took part in the work of the Conference. All the submitted papers (125) were reviewed by at least one of the members of the Scientific Committee and the accessory review team. The papers accepted for publication have been considered to be sufficiently original and to contain new data that deserve to be published in the Proceedings. Authors from USA, UK, Germany, France, Russia, Italy, Belgium, Check Republic, Slovenia, Ukraine, Bosnia and Hercegovina, beside Serbia and Montenegro, are included in the Proceedings, proving our international orientation.

Ninety-three papers selected by the Editors for inclusion in this volume are thematically presented in nine sections: **I Thin Films and Nanostructures; II Solid State Phenomena; III Advanced Materials; IV Nanomaterials; V Spectroscopic Characterization; VI Synthesis and Processing; VII Powders and Ceramics; VIII Composites and IX Biomaterials.**

The Editors wish to thank heartily to all members of the Scientific and Organizing Committees for their efforts to organize the conference successfully, and to perform their duties as Session Chairmen and reviewers. We wish to acknowledge our very special personal thanks to the foreign authors which participated at the Conference and sent the papers, contributing to the quality of this Proceedings. We also acknowledge our profound gratitude to foreign and domestic reviewers whose expert comments helped Editors to select the most original and contemporary papers.

Unfailing help and enthusiasm of Ms. Aleksandra Stojičić, secretary of the conference is gratefully acknowledged. The Editors wish to thank Aleksandra for her technical editing of the materials before, during and after the conference and for preparing Table of Contents, Author Index, Keyword Index, and other details for the Proceedings. The Editors also wish to thank Mrs. Verica Korica-Roglić for English grammar and syntax editing of all articles, as well as Ms. Smilja Marković and Mrs. Dragana Jugović for all the help at final stage of technical editing of the Proceedings.

Our gratitude to the Ministry of Science, Technology and Development of the Republic of Serbia for their constant financial support in organizing these Conferences and publishing their Proceedings.

Belgrade, December, 2003

Dragan P. Uskoković
Slobodan K. Milonjić
Dejan I. Raković

Welcome Address of Prof. Dragan Uskokovic, President
of Yugoslav Materials Research Society and Director
of the Institute of Technical Sciences of SASA at the Fifth
Conference of Yugoslav Materials Research Society
YUCOMAT 2003, Herceg Novi, September 15th, 2003

Honorable ladies and gentlemen, dear colleagues,

I have a great honour and pleasure to greet you in the name of the Yugoslav Materials Research Society and the Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, at the beginning of the Fifth YUCOMAT Conference and to wish that the program in front of you be the source of new information, useful discussions and interesting contacts. Although young, our Society notes in its record number of significant realizations that convince us that we are on the good path to grow into a similar Materials Research Societies worldwide, many of whom belong to far more developed countries than ours. Previous four conferences, held in 1995, 1997, 1999 and 2001, and their Proceedings published by Trans Tech Publications from Switzerland in its prestigious Materials Science Forum Edition, are visible proof of this. 170 articles published in these Proceedings and their SCI, between 0,5-1 in that period, presented us worthily to the world and thereby realized informal gatherings initiated many mutual research programs. This conference also is on the best way to keep the ascending line of the former ones and to get us to the rank of highly significant world events in this area.

Please allow me, honorable colleagues, to use this opportunity to express few personal opinions concerning present situation in the country, foremost connected to the condition of materials science and engineering between two conferences and tasks and goals of Yugoslav Materials Research Society. Thanks to unwise, or I should say, rabid politics of domestic potentates and high powers as well in the last decade of 20th century, our country stayed on the last place in Europe, far behind the ex-east-European countries that used to be significantly behind us. We expected a lot after the changes from October 5th 2000, but in one totally devastated country it is hard to expect that funds for science will have a fast rise. Inklings of improvement are visible, but solving of the fundamental problems didn't even begin. Science and knowledge are, unfortunately, still decorative categories and serve politicians only for folklore beautification. Funds for the science are probably still the lowest in Europe (0.32% of gross national product, less than 10 Euros per citizen in absolute figures), which is about 5-10 times less than in the countries joining European Union in 2004 (Slovenia, Hungary and Check Republic) and 30-40 times less than the EU average and 50-100 times less than in USA, Japan and highly developed European countries, like Germany, France, Great Britain, etc. Simultaneously, the most precious resource of this region – young, smart, ambitious, highly educated people are still leaving the country, not being able to wait for the solutions of their existential problems and conditions for quality research for who knows how long.

On the other hand, honorable colleagues, as you know materials science and engineering worldwide reaches sky-high and present the area of huge intellectual and technological challenges. Impact factors of the journals from the area of materials in the last years reached the journals from the area of physics and chemistry. Number of discoveries, whether in the domain of material characterization or new materials that were the winners of Nobel prizes, starting from X-ray diffraction, Raman and Moessbauer spectroscopy, electron and scanning tunnel microscopy, up to polymer synthesis, semiconductors, supramolecular chemistry, high-temperature superconductors and fullerenes, enabled this area to grow to the present level. Numerous national priorities were successfully realized by development and improvement of materials' characteristics. Furthermore, the times that are coming will be signified by small scale designing of the nanomaterials – atom by atom. This way of total control over materials' structure and characteristics represents the bases of

future nanotechnologies, whose influence on life and environment will be unimaginable from the present perspective.

I believe that there are few conditions and tasks without whose total fulfillment no serious step forward could be made here:

- The first condition is to enlarge funds for science and take them to the realistic level that corresponds to the ones in developed countries and in ones that we aspire to. That means that minimum of 1% of gross national product is necessary at once. Thereby, the existing funds would triple and get to the level of 30 Euros per citizen, reaching closer to the countries that we aspire to (Hungary, Slovenia and Czech Republic, where the funds are 50-100 Euros per citizen) and as much as possible bridge the long-lasting devastation in our science. Thus we would definitely achieve to break long free-fall of our science, stop exodus of young researchers and distinguished researchers of middle generation and significantly turn the treatment of science in positive direction.
- The second condition is overall democratization and depolitization of science and its overtaking by expert type organization. It is inadmissible that political suitability becomes again more important than knowledge and experience. True experts of apolitical inclination, as in the previous regime, are put aside while third-rate researchers are still skillfully making nets, damaging reputation of science a priori and compromising basic democratic principles of the social entity.
- The third condition is forming the creative ambience with generated conditions that inspire research programs and individuals of the highest quality. This would simultaneously make the defense mechanism against uncontrollable drain of our researchers abroad and slowly realize incorporation of our affirmed scientists in Diaspora and their drawing closer to Homeland through different ways of cooperation, most suitable to them. That is the best way for a small country like ours to find its place among great scientific-technological integrating processes worldwide and use its immense potentials scattered all over the planet.
- Development of new ways of cooperation that would unite research and education or research-education-innovation (industry), preferably in corresponding Centers of Excellence. This would simultaneously contribute to development of totally new models of cooperation that would stimulate scientists to be more enterprising and realize their research and patented solutions through small-scale production that is already in demand on domestic and foreign market. This approach has been already successfully functioning for a long time in developed countries and simultaneously forcing scientists to think, even before they start working on a new program, how to make results evident not only through highly rated journals but also through a profitable business. At the same time, one should constantly bear in mind the fact that products from the small countries as ours can find their place at international market only if they are of the highest quality and the result of extraordinary scientific achievements.

I will conclude with a certainty that in this millennium luck will prefer peoples and countries that highly appreciate and invest in science. They will own ideas that will be foundations for new advanced technologies as a support of future industry. At the same time, we should not forget that time has come with every research step we make from the idea and suggestion for the new project to the laboratory experiment, technology and patent, to consider profoundly – where this leads to. How can obtained results be used or abused? It is time, if we did not do it before, to consider at every moment how to contribute to preservation of our small maybe unique oases in universe called PLANET EARTH and to make sure that our results are benefiting mankind. It is my opinion that our Materials Research Society is on the best way to demonstrate all this through personal example, for our idea has come at the right moment and has fallen on the appropriate ground.

Dear colleagues, I wish you again successful work during this Conference and pleasant stay at this lovely city of flowers, art, beauty and warmth.

List of Reviewers

- Adnadjević, B., Belgrade, Serbia & Montenegro
 Amadelli, R., Ferrara, Italy
 Andrijević, R.A., Chernogolovka, Russia
 Antić-Fidančev, E., Paris, France
 Antonijević, M., Bor, Serbia & Montenegro
 Ardizzone, S., Milan, Italy
 Avramov-Ivić, M., Belgrade, SM
 Avvakumov, E.G., Novosibirsk, Russia
 Babić-Stojić, B., Belgrade, Serbia & Montenegro
 Balić-Žunić, T., Copenhagen, Denmark
 Barbu, M., Wien, Austria
 Baroli, B., Cagliari, Italy
 Blinc, R., Ljubljana, Slovenia
 Boh, B., Ljubljana, Slovenia
 Bojanić, S., Madrid, Spain
 Bošković, S., Belgrade, Serbia & Montenegro
 Braun, T., Budapest, Hungary
 Brujić-Okretić, V., London, UK
 Budinski-Simendić, J., Novi Sad, SM
 Calleja, E., Madrid, Spain
 Čeh, M., Ljubljana, Slovenia
 Ceulemans, J., Leuven, Belgium
 Chatzidimitriou-Dreismann, C.A., Berlin, DE
 Clasen, R., Saarbruecken, Germany
 Colomban, Ph., Thiais, France
 Cowgill, M., Upton, NY, USA
 Davidović, M., Belgrade, Serbia & Montenegro
 Delplanche, J.-L., Bruxelles, Belgium
 Djokić, S., Alberta, Canada
 Djonlajić, J., Belgrade, Serbia & Montenegro
 Djurdjević, M., Windsor, Canada
 Djurić, B., Belgrade, Serbia & Montenegro
 Donko, Z., Budapest, Hungary
 Drogenik, M., Ljubljana, Slovenia
 Duggal, M.S., Leeds, UK
 Dvornić, P., Midland, MI, USA
 Eadie, R., Alberta, Canada
 Elazar, J., Belgrade, Serbia & Montenegro
 Fedoroff, M., Vitry-sur-Seine, France
 Flor, G., Pavia, Italy
 Goeken, M., Erlangen, Germany
 Gogolewski, S., Davos, Switzerland
 Grgur, B., Belgrade, Serbia & Montenegro
 Grimes, R., London, UK
 Hameroff, S., Tucson, AZ, USA
 Han, K., Tallahassee, USA
 Harrison, P., Leeds, UK
 Herbig, R., Freiberg, Germany
 Hermel, W., Dresden, Germany
 Herrmann, M., Dresden, Germany
 Hofer, F., Graz, Austria
 Hofmann, H., Lausanne, Switzerland
 Hogg, P., London, UK
 Holsa, J., Turku, Finland
 Hussey, N., Bristol, UK
 Ignjatović, N., Belgrade, SM
 Ikonić, Z., Leeds, UK
 Ilavsky, M., Prague, Czech Republic
 Ilić, N., Saarbruecken, Germany
 Janačković, Dj., Belgrade, SM
 Jakanović, V., Belgrade, SM
 Jordović, B., Čačak, Serbia & Montenegro
 Jovanić, B., Belgrade, Serbia & Montenegro
 Jovanović, M., Belgrade, SM
 Kandić, D., Belgrade, Serbia & Montenegro
 Karwasz, G., Trento, Italy
 Khan, T.I., Calgary, Canada
 Khodan, A., Moscow, Russia
 Khoi, L.V., Warsaw, Poland
 Kolar-Anić, Lj., Belgrade, SM
 Konstantinovic, M., Leuven, Belgium
 Koruga, Dj., Belgrade, Serbia & Montenegro
 Korugić-Karasz, Lj., Amherst, USA
 Kosmulski, M., Lublin, Poland
 Kowal, A., Cracow, Poland
 Krakovski, I., Prague, Czech Republic
 Krstajić, N., Belgrade, Serbia & Montenegro
 Krstić, V., Kingston, Canada
 Langhammer, H.Th., Halle, Germany
 Laušević, M., Belgrade, SM
 Leovac, V., Novi Sad, Serbia & Montenegro
 Leprince-Wang, Y., Marne la Vallee, France
 Lipkowski, J., Guelph, Ontario, Canada
 Ljevak, M., Sarajevo, Bosnia & Hercegovina
 Lukić, S., Novi Sad, Serbia & Montenegro
 Lund, A., Linköping, Sweden
 Maksimović, M., Belgrade, SM
 Mandelis, A., Toronto, Canada
 Mares, J.A., Prague, Czech Republic
 Mariucci, L., Roma, Italy
 Marković, N., San Francisco, USA
 Martin, I., Basel, Switzerland
 Mehandžijev, D., Sofia, Bulgaria
 Meissner, B., Prague, Czech Republic
 Mentus, S., Belgrade, Serbia & Montenegro
 Menzel, F., Hanau, Germany

Mijović, J., New York, USA
 Milanović, V., Belgrade, Serbia & Montenegro
 Milonjić, S.K., Belgrade, Serbia & Montenegro
 Milosavljević, D., Kragujevac, SM
 Milošević, O., Belgrade, Serbia & Montenegro
 Miloševski, M., Skoplje, Makedonia
 Minić, D., Belgrade, Serbia & Montenegro
 Mioč, U., Belgrade, Serbia & Montenegro
 Mišković-Stanković, V., Belgrade, SM
 Mitrić, M., Belgrade, Serbia & Montenegro
 Montone, A., Rome, Italy
 Mozgawa, W., Cracow, Poland
 Muecklich, F., Saarbruecken, Germany
 Nagaraja, K.S., Chennai, India
 Nedeljković, J., Golden, CO, USA
 Nedkov, I., Sofia, Bulgaria
 Nemeček, P., Bratislava, Slovakia
 Nenadović, T., Belgrade, Serbia & Montenegro
 Neophytides, S., Patras, Greece
 Nikolić, B., Belgrade, Serbia & Montenegro
 Nikolić, Z.S., Niš, Serbia & Montenegro
 Osawa, E., Chiba, Japan
 Pekker, S., Budapest, Hungary
 Perreux, D., Franche-Comte, France
 Petrovski, B., Darmstadt, Germany
 Petrzhik, M., Moscow, Russia
 Petzow, G., Stuttgart, Germany
 Pissis, P., Athens, Greece
 Plavšić, M., Belgrade, Serbia & Montenegro
 Pluvinaige, G., Metz, France
 Pop, V., Babes-Bolyai, Romania
 Popescu, M., Bucharest, Romania
 Popov, K., Belgrade, Serbia & Montenegro
 Popović, I., Belgrade, Serbia & Montenegro
 Popović, Z., Valencia, Spain
 Pryadko, L., Kiev, Ukraine
 Radmilović, V., San Francisco, USA
 Radonjić, B. Podgorica, Serbia & Montenegro

Radu, V.C., Bucharest, Romania
 Raković, D., Belgrade, Serbia & Montenegro
 Romčević, N., Belgrade, SM
 Sainte Catherine, C., Gif-sur-Yvette, France
 Schmuecker, M., Koeln, Germany
 Scholz, R., Chemnitz, Germany
 Schuetze, M., Frankfurt on Main, Germany
 Sedmak, S., Belgrade, Serbia & Montenegro
 Seifert, G., Dresden, Germany
 Šetrajčić, J., Novi Sad, Serbia & Montenegro
 Spasić, A., Belgrade, Serbia & Montenegro
 Spirkova, M., Prague, Czech Republic
 Srdanov, V.I., Santa Barbara, CA, USA
 Srdić, V., Novi Sad, Serbia & Montenegro
 Srećković, T., Belgrade, SM
 Stevanović, M., Belgrade, SM
 Stojanović, B., Belgrade, SM
 Stollhoff, G., Stuttgart, Germany
 Suszynski, Z., Koszalin, Poland
 Suvorov, D., Ljubljana, Slovenia
 Suzuki, R.O., Kyoto, Japan
 Tumba, J., Leeds, UK
 Tadić, B., Ljubljana, Slovenia
 Tošić, B., Novi Sad, Serbia & Montenegro
 Trasatti, S., Milano, Italy
 Tveryanovich, Y.S., St. Peterburg, Russia
 Vaireanu, D.-I., Bucharest, Romania
 Verlinden, B., Leuven, Belgium
 Veselinović, D., Belgrade, SM
 von Sonntag, C., Muelheim, Germany
 Vondrak, J., Prague, Czech Republic
 Vragovic, I., Chemnitz, Germany
 Vukčević, M., Podgorica, SM
 Wedig, U., Stuttgart, Germany
 Wood, J.T., London, Ontario, Canada
 Živković, Lj., Niš, Serbia & Montenegro
 Živković, S., Belgrade, Serbia & Montenegro
 Zlatanović, M., Belgrade, SM