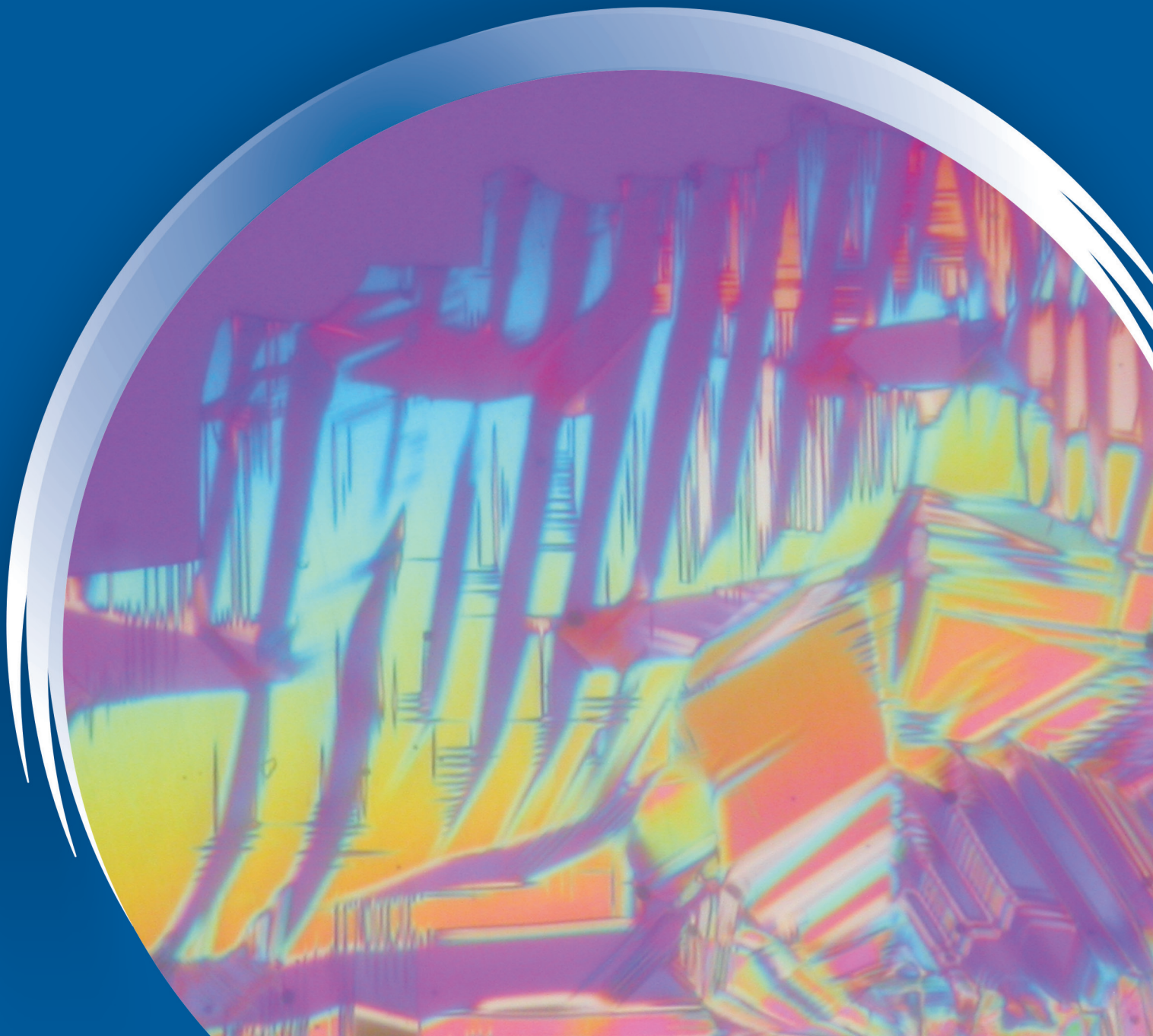


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Editorial | Uvodnik

This issue is devoted to the late Professor Marija Kosec.

*Prof. Dr. Marija Kosec
(1947 – 2012)*



»...Prof. Marija Kosec has been a shining star on the sky of Slovenian Science and Research...«
Prof. Marko Topič, the President of the MIDEM Society on 4th Jan 2013

Professor Marija Kosec, or Marička, as almost everyone called her, was born on the 5th September 1947 in Šinkov turn, Slovenia. She graduated in 1970 in chemical technology, received her MSc in 1975 and her PhD in chemistry in 1982 at the University of Ljubljana, Slovenia, under the supervision of Professor Drago Kolar. The topic of her Master Thesis was lead-free piezoelectric sodium potassium niobate, which, after being almost forgotten for about 25 years, became extremely popular with the revived interest in environment-friendly lead-free piezoceramics. Her doctoral thesis involved the study of phase relations in calcium uranate systems and within this period she mastered the techniques of thermal analysis.

Since 1971 she was employed at the Jožef Stefan Institute (JSI), Ljubljana, Slovenia, and in 1997–2001 she was the Head of the Ceramics Department followed by being the Head of the Electronic Ceramics Department (2002–2012). In 2007–2009 she was the President of the Scientific Council of Jožef Stefan Institute. In 1993 she was a visiting scientist at the Ceramics laboratory of Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland. In the years 2004–2009 she was also the Director of the Slovenian Centre of Excellence “Materials for electronics of next generations and other emerging technologies”, and in the period 2009–2012 of the Centre of Excellence “Advanced Materials and Technologies for the Future” (NAMASTE).

Since 1999 she was Professor of Materials Science at the University of Ljubljana, with courses at graduate and post-graduate level. She was active in the Jožef Stefan International Postgraduate School since its establishment in 2004 as its Vice-President. She was a visiting professor at Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, Shizuoka University, Japan, and for shorter periods at a number of other universities and institutes. She was Adjunct Professor at Xi’an Jiaotong University, China. She was an inspiring advisor to many PhD students at the University of Ljubljana, the Jožef Stefan International Postgraduate School and the University of Oulu, Finland.

She served as a member or chair of many scientific societies, committees or advisory bodies both in Slovenia and abroad. In the period 2005–2006 she was the President of the Slovenian Academy of Engineering. Since 1999 she was a member of the European Liaison Committee of International Microelectronics and Packaging Society (IMAPS). In 2001 she became a member of the Ferroelectrics Committee at IEEE.

Professor Kosec was a very active and strong supporter of the Society for Microelectronics, Electronic Components and Materials (MIDEM Society) and its long-term member. In the years 1996–2005 she was the President, and in the periods 1989–1996 and 2005–2011 the Vice-President.

In recognition to her achievements she was awarded the title Ambassador of Science of the Republic of Slovenia (2003), she was a recipient of the Zois Award, the highest national science award (2006), and of the Puh recognition for the implementa-

tion of research results in industry in 2009. In 2010 she received the Ferroelectrics Recognition Award from IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society for her significant contributions to the processing science and technology of ferroelectric powders, bulk ceramics, thin and thick films.

The research work of Prof. Kosec was on synthesis and processing of ceramic materials for electronics, especially ferroelectrics and piezoelectrics. She established strong collaborations with researchers from complementary fields, especially from solid-state physics and electronics both in Slovenia and around the world. Her contribution was in better understanding and consequently controlling the synthesis of complex perovskite materials in solutions, colloidal systems, by mechanochemical activation or reactions in solid state.

It is worthwhile to note the highly technologically demanding processing of transparent electrooptically active lead lanthanum zirconate titanate bulk ceramics, which she undertook in the frame of a military project together with colleagues from the Condensed Matter Physics Department within JSI, in 1980s.

In 2001 the group of Prof. Kosec took part in the first European framework project on environment-friendly lead-free piezoceramics based on alkaline niobates. Her first publication on sintering of sodium potassium niobate from 1975, which had been her Master degree topic, eventually became the seminal paper on sintering of this still not thoroughly-understood material. Together with the colleagues from the Condensed Matter Physics Department she discovered a new group of lead-free relaxors. In the frame of a European project, the group prepared for the first time single crystals of sodium potassium niobate by solid state crystal growth with piezoelectric properties exceeding those of the polycrystalline counterpart.

Research of ferroelectric thick films (thickness range of a few 10 μm) is among the notable achievements of Prof. Kosec and her group. In 1992 the German printing company MAN Roland Druckmaschinen patented the process of ferroelectric printing and in order to prove the concept, ferroelectric thick films with the thickness of a few 10 μm with almost theoretical density were needed. At that time there was almost no knowledge on ferroelectric thick films processing. Professor Kosec and her colleagues succeeded to process the films with required materials and functional properties and patented the processing of such films. Integration of ferroelectric and piezoelectric thick films on different substrates was later the topic of a number of European framework projects. The development of integrated medical ultrasound transducer in collaboration with colleagues from the University François-Rabelais, Tours, France, and pressure sensors with Slovene companies HIPOT RR in HYB should be also noted.

In the field of Chemical Solution Deposition (CSD) of ferroelectric $\text{Pb}(\text{Zr,Ti})\text{O}_3$ thin films (i.e., with thicknesses of a few 100 nm) she addressed together with her colleagues the problem of chemical homogeneity on sub-nanometre scale. The exceptional practical outcome of this work from more than 10 years ago was in major lowering of the crystallization temperature of the perovskite phase from the usually reported 600-650 $^{\circ}\text{C}$ to as low as 400 $^{\circ}\text{C}$, which is today still among the lowest reported crystallization temperatures. The value of this achievement lies in the easier integration of thin films into electronic components where temperature plays an important role. Due to the expertise in CSD of ferroelectric thin films the group of Professor Kosec collaborated in European framework projects on microwave phase shifters based on tunable ferroelectric thin film, thin film capacitors with exceptionally high dielectric permittivity and thin films and 2D-structures for oxide based transparent electronic components. Only a few years ago the extremely large electrocaloric temperature change in lead lanthanum zirconate titanate thin films was confirmed by direct measurements in collaboration with colleagues from the Condensed Matter Physics Department within JSI.

Professor Kosec was author or co-author of more than 300 scientific papers in international journals and of about 15 chapters in books. She gave more than 150 invited talks at international conferences and at different research institutions including Max Planck Institut, MIT, Tokyo Institute of Technology, and she was extremely proud of having the opportunity to visit and give lectures at important Japanese producers of electronic components including Murata, TDK, Panasonic and Toshiba.

She endeavored to connect the basic research with the applied research, development and industry. She was principal investigator of more than 40 contracts with industry, she lead or collaborated in more than 20 European framework programme or other international projects. Together with her colleagues she wrote more than 160 technical reports, eleven national patents, one European and one US patent. To strengthen good collaboration between academia and industry she organized or supported organization of different meetings where knowledge and skills from both parts could merge.

In September 2012 Professor Kosec was the chair of the 48th International Conference on Microelectronics, Devices and Materials with the Workshop on Ceramic Microsystems; however, due to the fast progressing of her illness she could not take active part in this very successful event. She died only a few months later, on December 23, 2012.

Her optimistic approach to life in general and to her research in particular, her sharp mind and her extensive background knowledge, her sincere interest in people and her generous heart are missed.

Prof. Barbara Malič
Electronic Ceramics Department
Jožef Stefan Institute
Ljubljana, Slovenia.

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