



Preface

Special Issue of Surface and Coatings Technology on 25 Years of TiAlN Hard Coatings in Research and Industry



This Special Issue of Surface and Coatings Technology is dedicated to Professor Ivan Petrov, who has contributed outstanding work in the field of materials science and advanced surface engineering. Professor Petrov is a true pioneer in the science and technology of hard coatings and his papers have been, and still are, must-reads for both newcomers to the field and experienced colleagues. The individuals and research teams that contribute to this Special Issue are representatives of a world-wide community and offer sincere thanks to Ivan Petrov for excellent and pleasant cooperation, fruitful scientific discussions, wonderful teaching and training sessions, intense contribution to science organizations, and – especially – for his friendship.

Nearly 25 years ago, the first published papers on the deposition of innovative TiAlN coatings set a milestone in the research and development of hard, protective coatings and a breakthrough in industrial applications. Since these pioneering days, research on novel coating materials and design has exploded and includes metastable materials, multilayers, composites, vacuum and plasma-based deposition methods, thin film and process characterization, simulation, and modeling. The corresponding publications constitute a solid scientific and technological foundation

for today's use of hard coatings. The reports on successful synthesis, scale-up, and industrial application of TiAlN coatings have opened the door to a new world of advanced surface engineering, and thus inspired further research and novel applications.

Today, TiAlN-based coatings are the backbone of the manufacturing and tool industry worldwide. Significant progress has also been made in understanding the correlation between thin film synthesis, microstructure formation, and application-oriented properties and behavior. Several new high-performance protective coatings are under development for industrial utilization. Among them, novel transition-metal nitride based materials continuously attract very high interest, both in fundamental research and industry. It is expected that the development and use of new deposition techniques such as pulsed plasma deposition (HIPIMS) and hybrid PVD methods will offer potential applications far beyond that of conventional TiAlN coatings. Also, new ways of mixing alloys and their micro- and nanostructural design continue to drive the field forward. Here, Surface and Coatings Technology is a prominent vehicle for publishing.

This Special Issue focuses on the most important developments in the field of hard, protective, and multifunctional coatings since the appearance of first reports on TiAlN. It covers transition-metal nitride based thin films and related materials, as well as new deposition technologies with high potential for industrial utilization. It addresses the latest developments in thin film design, simulation and modeling, synthesis and analytics, and applications.

The Special Issue consists of several original research and review articles. The intention is to offer the reader deep insights into the newest, outstanding R&D work on high-performance hard coatings and their related technologies. This collection addresses interests of scientists, as well as engineers and technicians, and connects fundamental research topics with practical applications. Following this philosophy, the Special Issue contributes to the objective of developing knowledge-based engineering materials design as it relates thin film constitution and microstructure with properties and performance at the meso- and nanoscales.

Ivan Petrov has left his footprints in all scientific fields addressed by this Special Issue. His enormous impact in the hard-coatings community is documented by a large number of published articles, exciting lectures at conferences, and many awards. An early and detailed paper is "Microstructure modification of TiN by ion bombardment during reactive sputter deposition" (published in *Thin Solid Films* 169, 1989, 299–314, jointly with Lars Hultman, Ulf Helmersson, Jan-Eric Sundgren, and Joe Greene). Another important article is "Microstructure evolution during film growth" (published in *Journal of Vacuum Science and Technology A* 21(5), 2003, S117–S128, jointly with Peter Barna, Lars Hultman,

and Joe Greene). This list could be easily continued with significant contributions to TiAlN thin films, to pulsed plasma deposition, and many other topics. Among his awards and honors, we are pleased to announce his election as AVS president for 2015. This election shows another side of Ivan Petrov: his long-standing efforts to serve our community in a variety of functions, always with a focus on promoting collaborations with a strong emphasis on supporting young colleagues launching their careers. Within his AVS activities, we appreciate his enormous contribution to the most important conference in our field, the International Conference on Metallurgical Coatings and Thin Films (ICMCTF). In addition, we note his continued activities in IUVSTA, which reflects his vision across borders and political entities. It was at an IUVSTA event that he entered the international stage: the International Summer School on Processes of Thin Film Formation at Fonyod, Lake Balaton, Hungary, in autumn, 1980.

As a Professor at the Frederick Seitz Materials Research Laboratory and the Materials Science Department at the University of Illinois in Urbana, Illinois, U.S.A. and as a Guest Professor in the Department of Physics, Thin Film Physics Division, of Linköping University, Sweden, Ivan Petrov serves as an outstanding teacher who has positively influenced the careers of numerous students. Many of his previous Ph.D. students are highly respected Professors themselves at various universities. Finally, we should not forget his tremendous impact as Editor of Surface and Coatings Technology over many years. Ivan Petrov is now, on the occasion of his 65th birthday, overlooking a wonderful and exciting lifework in thin film science. With this Special Issue, his colleagues and friends congratulate him cordially and wish him continued success in all his endeavors.

The Editors of this Special Issue on “25-Years of TiAlN Hard Coatings in Research and Industry” would like to thank the co-editors of Ivan Petrov

of Surface and Coatings Technology (Professor P. Martin, Professor H.C. Man, Dr. J. Patscheider, Professor S. Aouadi, and Professor C. Rebholz) and the journal manager and colleagues at Elsevier (Dr. J. Wijnen, Dr. S. Kannappan, and team) for their superb support in developing this Special Issue of Surface and Coatings Technology. The contribution of numerous, highly regarded colleagues is very much appreciated as well as the work of many colleagues in peer-reviewing the manuscripts. Finally, we hope that you as a reader will find this Special Issue especially important, in honor of Professor Ivan Petrov and everyone who has contributed to the success of TiAlN-based coatings and related fields.

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