



Prof. Arutiun Ehasarian

Professor of plasma science and surface engineering

Short Citation

For the use of plasma physics in coating technology and engineering, through seminal contributions to the science and industrial applications of High Power Impulse Magnetron Sputtering for substrate pre-treatment and deposition of coatings and thin films.

Citation

The emergence of the High Power Impulse Magnetron Sputtering (HIPIMS) is the most significant development in plasma vapour deposition (PVD) technology in the past decade. Its importance to the field is at the same level as the invention of the magnetron itself. After more than a decade of dedication to the development of this technology, the undisputed leader in the area of HIPIMS is Professor Arutiun P. Ehasarian of Sheffield Hallam University, UK. His accomplishments are many, and include: significantly deepening the understanding of the fundamentals of the process; being the first to implement the technique using industrial scale equipment; patenting HIPIMS metal ion surface pre-treatment; and being the first to analyze the growth mechanisms of complex films. Furthermore Professor Ehasarian has been a leader in organising scientific forums to exchange knowledge and accelerate the progress of this new area of plasma physics applications.

Professor Ehasarian's central role in developing understanding of the physics of the HIPIMS discharge and applications to thin film technology is reflected by the fact that, in 2003, he was awarded the first UK grant to study the fundamental physics of HIPIMS. His research provided the first direct evidence of the presence of large fractions of singly and doubly charged metal ions in HIPIMS, through electron impact ionisation. He discovered a new regime of plasma confinement and mechanism for discharge sustainment. He elucidated the origins of the ion and electron energy distribution functions, and found conditions for high levels of dissociation of reactive gas, leading to changes in crystallographic texture and extreme densification of the deposited films. In 2006 he discovered strong instabilities in the HIPIMS plasma which self-organised along the racetrack, causing localised ejection of plasma across magnetic field lines. This has led to a revision of the understanding of the working principle of the magnetron itself.

Professor Ehasarian is among the world leaders in the effort to make HIPIMS accessible to the wider community and to develop its industrial applications. He was the first in the field to accomplish the scale-up of the HIPIMS process. Based on his design, Hüttinger manufactured the first industrially viable power supply to drive targets with an area of 2000 square centimetres. This instigated the industrialisation of the HIPIMS technology worldwide. Professor Ehasarian has supported the establishment of the largest production HIPIMS coating facility at Ionbond UK in 2014. Based on his work, Zimmer Biomet successfully implanted HIPIMS-coated artificial joints in a sheep test model; this demonstrated unparalleled biocompatibility, metal ion release reduction, and adhesion.

Professor Ehasarian patented the HIPIMS etching technology which has been licensed to number of companies in Europe and the USA. Both Hauzer and CemeCon market HIPIMS systems for hard coatings, with impressive sales. Two of their customers, Walter AG and Mitsubishi Materials, offer HIPIMS-coated cutting tools in their commercial portfolio. Collaboration with Oerlikon Balzers to introduce production technology for wafer metallisation led to several systems operating in the field. Together with the Rutherford Appleton Laboratory (UK), Professor Ehasarian developed HIPIMS technology for coatings for cryogenic coolers for space satellites, achieving spaceflight qualification.

Professor Ehasarian has been the clear leader in rallying the international scientific community to focus on the new HIPIMS technology, and to promote the dissemination and exchange of knowledge. As early as 2003 he organised and chaired the first HIPIMS sessions at international conferences in the USA. Since 2010 he has chaired the International Conference on HIPIMS, organised jointly with the Fraunhofer IST and endorsed by the European Joint Committee.

In general the whole body of Professor Ehasarian's work is impressive. It provides a rare example of exceptionally broad research across the whole spectrum from fundamental studies to large scale industrialisation.