

The Practice of Reactive Sputtering

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This Society of Vacuum Coaters Tutorial, in cooperation with EFDS, will be presented by Allan Matthews, The University of Sheffield, United Kingdom

Topical Content

- Basics of reactive sputtering
- Flow control versus partial pressure control of the reactive gas
- Power supplies for reactive sputtering
- Reactive gas sensors
- Large area reactive sputtering
- Control systems for reactive sputtering
- Multiple gas reactive sputtering
- Reactive high power pulsed magnetron sputtering

This Tutorial is intended for engineers, technicians, materials scientists, and coating developers, who have a desire and need to understand how the reactive sputter deposition process really works. The goal of the Tutorial is to give the student a thorough understanding of all of the factors that affect the reactive sputtering process in order that the student can apply this knowledge to improve their reactive deposition process and achieve both high deposition rates and excellent film properties.

This Tutorial covers the basics of reactive sputtering followed by a comparison of the use of flow control versus partial pressure control of the reactive gas. The latter allows operation in the transition region between the metallic and poisoned states of the target, and films can be deposited at much higher rates with excellent properties using partial pressure control compared to flow control of the reactive gas. Along with using partial pressure control, it is important to use the right type of power to assure that there is no arcing during the deposition. Which type of power to use and along with which partial pressure sensor are reviewed. Large area coating presents special challenges for the control of the reactive gas, and the need for multiple gas inlets along the length of a long cathode and sensing in each gas inlet zone are discussed. The requirements for a partial pressure control system along with commercially available controllers are presented. Multiple gas reactive sputtering and reactive high power pulsed magnetron sputtering (HPPMS) are emerging areas that are advancing the state of the art for reactive sputtering. How they work and what factors are important for controlling these two processes are discussed.

The Tutorial course materials have been prepared by Dr. Bill Sproul, Reactive Sputtering, Inc., San Marcos (USA).

Instructor: Allan Matthews, The University of Sheffield, Sheffield (United Kingdom)

Allan Matthews is Professor of Surface Engineering, and Head of the Department of Engineering Materials at the University of Sheffield, UK. He has been working on plasma-assisted PVD processes for about 30 years. He spent his early career in the aerospace industry and subsequently carried out research into enhanced plasma-based coating and treatment processes as well as test and evaluation methods. He holds eight patents in these fields and has authored or co-authored over 330 publications, including the book, Coatings Tribology (Elsevier, 2009). He is a SVC Board Member and a former Chair of the Executive Committee of the Advanced Surface Engineering Division of the AVS. He is a former Chairman, Symposium Committee member and Proceedings Editor for the ICMCTF Conference. He is a member and past Chair of the British Vacuum Council and a Co-Editor of the Elsevier journal, *Surface and Coatings Technology*.