MATERION ADVANCED MATERIALS GROUP

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In This Issue

Keeping Pace with Technology

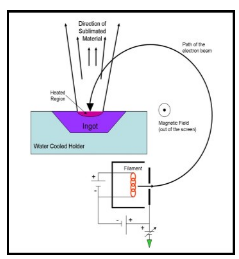
The evolution of optical coatings applications is limitless, and requires continuing development of deposition processes and materials. Both technologies have responded to new requirements for environmental stability, better optical quality and greater durability which were not previously required nor anticipated. Following is a review of a few preferred PVD processes and current applications, some of which were reported at the *Optical Interference Conference* (OIC), Tucson, June 2016.

Sputtering Replaces E-beam in Critical Applications

The introduction of electron-beam evaporation more than 50 years ago enabled high rates of deposition of high-temperature compounds such as the transition metal oxides. Those oxide materials are used in coatings for UV through Mid-IR regions, and commonly include SiO_2, Al_2O_3, HfO_2, Ta_2O_5, TiO_2, Y_2O_3, and others. However, thermal evaporation by a beam of electrons is an inherently unstable thermodynamic process. To help mitigate the instability, starting materials have been specially processed to provide greater compositional and physical uniformity. That processing consists of: deliberate production of conductive sub-oxide compositions, pre-melting and forming shaped sources, controlling density, and additive mixing. Starting material preparation and deposition process parameters work in concert to influence the optical and physical (mechanical) properties of the deposited thin-film layers.

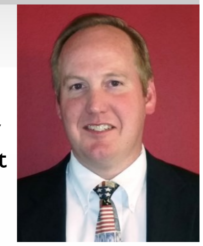
Some degree of control over growth morphology is provided by simultaneous energetic ion bombardment during growth. E-beam evaporation with ion assist (IAD) is applied to increase packing density in growing film layers at lower substrate temperatures and to promote amorphous micro/nano-structural morphology. Both properties produce coatings with high consistency and improved environmental stability. [Read More….](#)

Reactive Deposition - Enabling Performance



There are aspects of thin film deposition where the main compound not only dominates the growing film but is also engineered to optimize the difference between the evaporation charge and the thin film itself. In comparison to metal thin films, dielectric compounds degrade during evaporation. Or, they can seriously challenge sputtering processes with variable conductivity, mechanical toughness, particles and damaging arcs. Whether to compensate for decomposing evaporation material or to create the highest quality full compound thin films, the reactive deposition process enables high quality performance coatings. In the first and perhaps lowest energy and lowest film density case, the material of interest is an oxide compound. In the classical e-beam deposition, the high-energy beam is directed onto the evaporation material held inside a water-cooled crucible. While often used for easier clean up, liners also moderate the heat flow from the starter charge or granules. This can contribute to rather exotic competing cooling challenges during the iterative heating and cooling of a typical high and low index optical design. For example, the most prolific high index material in the Visible and Near Infrared (VIS-NIR) region is Titanium Dioxide (TIO2). [Read More…](#)

Face to Face



Meet Kent Hutchings, Technical Manager for New Product Development. Kent has been with Materion for five years and is currently working on sputtering targets for thin film deposition and thermal interface materials for microelectronic applications. He is located in our Milwaukee, WI facility and reports to Katie Gardinier, Materion Advanced Materials Director of Technology.

Commenting on his time at Materion, Kent appreciates the opportunity to work with a wide range of new materials and processes. He says, "Finding new ways of doing things keeps things really interesting!" He also enjoys engaging people with a diverse set of background experiences and perspectives from around the company.

Kent previously spent time in Pennsylvania while working on his MS in Materials Engineering with a ceramics focus and recently graduated from Marquette University with a Masters in Business Administration. His career background included US Air Force industry-funded program work as a ceramic engineer. He handled such responsibilities as powder processing, tape casting, lamination, sintering, characterization, and electrochemical testing of oxygen separation membrane devices. [Read more about Kent...](#)

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