Providing expert PVD solutions worldwide

SPUTTERING COMPONENTS®

IONSCI

Newsletter

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SCI engineer puts head in ion clouds

While clouds in the sky can dampen our mood or even our plans for the day, ion "clouds" that form in rotary cathode vacuum chambers can potentially have a negative effect on the sputtering process.

Patrick Morse

Although these ion clouds appear to have little or no influence on coating uniformity, targets erode at a greater rate where there are ion clouds, adversely affecting target utilization and thus process efficiency.

Patrick Morse, senior applications and development engineer at Sputtering Components, is studying these ion clouds and presented his early findings at the Society of Vacuum Coaters Conference in Rhode Island earlier this year.

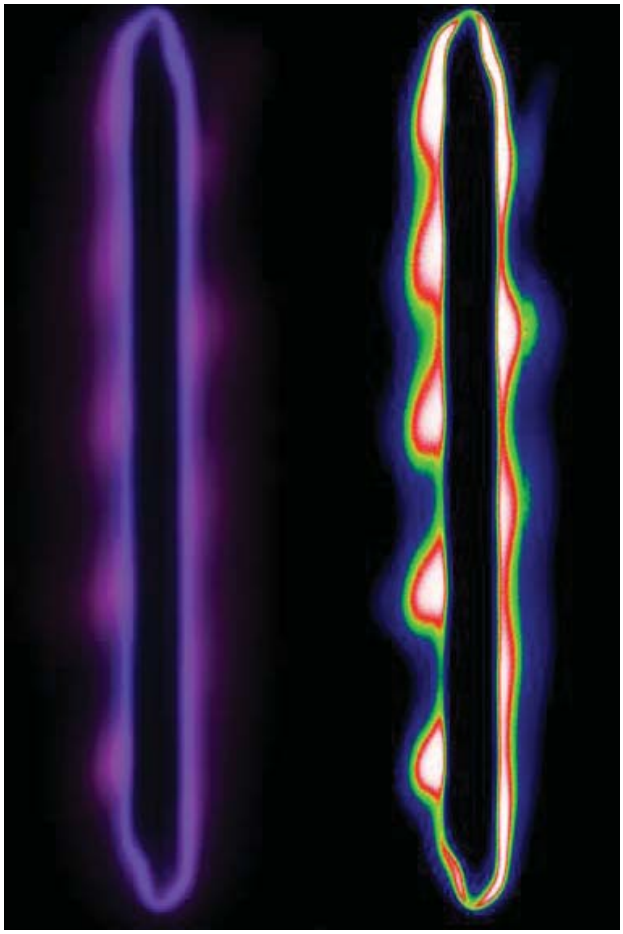
Also known as "spokes" (Anders) or "local ionization zones" (Janes and Lowder), ion clouds are bright spots in the plasma. With research focused on DC magnetrons with small, disc targets, they were said to rotate around the plasma "racetrack" and were known to relate to discharge power density.

But with the thin film industry using stronger magnetic fields for confining the plasma on large-area rotary magnetrons, ionization clouds became visible to the naked eye, and Morse's interest piqued. He found other factors that influenced ion cloud formation and came up with a model and formula that predicts when they will occur.

Besides discharge power, Morse discovered that ion cloud formation also depends on process gas pressure, chamber geometry, the type of target material, and the magnetron magnetic field strength.

Furthermore, using high speed thermal video, Morse observed that although ionization clouds oscillate back and forth, they do not appear to rotate around the racetrack, and that is why target utilization is decreased.

Morse found that with increasing the process pressure, the number of ionization clouds decreases until each side of the racetrack appears to have a single ionization cloud. But if the pressure is kept constant and the plasma discharge power is increased the opposite trend takes place: the intensity of the ionization clouds increases.



True color ionization cloud image (left) and a corresponding intensity gradient (right) of an aluminum target running in DC mode.

Morse also related power type to cloud formation. Switching to 10 kW, 40 kHz AC, there were brighter sections in the plasma, but they were not shaped the same as the ion clouds observed under DC sputtering.

The layout of the vacuum chamber also influences ion cloud formation,

Continued on page 2

Inside this issue...

Technology Team grows

Sputtering Components engineer **Greg Halvorson** has recently been promoted to Service Manager while **Ethan Arendt** has joined SCI as a Research & Development Engineer.

Greg Halvorson

Ethan Arendt

Both positions are part of SCI's growing Technology Team and report to director of Engineering **Robert Meck**.

Halvorson will be SCI's focal point for worldwide service. Besides driving service issues to closure, he will manage service contracts and create and deploy product training and education to enhance our customers' overall SCI experience.

Along with a Manufacturing Engineering degree from Minnesota State University in Mankato, MN, Halvorson brings five years of engineering design experience at SCI and an additional 17 years of industrial coating experience to this challenging and important position.

Arendt has a recent degree in Aerospace and Mechanics Engineering from the University of Minnesota.

In his role at SCI, he will help meet customer demand for new and improved PVD products by expanding the Technology Team's abilities to develop and qualify new technologies, materials and designs.

SCI products will be part of Guardian's new "jumbo" coater

Sputtering Components, Inc. products will be used in Guardian Glass' new jumbo coater, currently under construction at its Carleton, Michigan glass manufacturing complex.

By coating glass in jumbo sizes, Guardian Glass can supply larger sheets of coated glass to its customers for fabrication into finished insulating glass units for glass facades and windows and significantly reduce lead times for customers.

Montreal's Deloitte Tower contains over a quarter million square feet of Guardian glass. (Wikipedia)

"SCI products have performed extremely well in our testing," said Dan Rogers, equipment manager for Guardian's Science & Technology Center.

Recently, SCI held several workshops with the Guardian Glass team at SCI's facility in Owatonna, MN. Guardian found the training very beneficial, said **Mike Murphy**, account manager at SCI. "They were extremely impressed with SCI and our people and their knowledge," he said.

While Guardian operates many large area coaters around the globe, the new one in Carleton will be the company's first jumbo coater in North America.

Architects are increasingly designing monumental projects using very large volumes of coated glass that deliver an attractive building facade with more expansive views and higher natural light penetration.

The new coater will produce high performance, energy-saving low-E coatings on jumbo glass sizes. It is slated to begin operations in 2018.

Model, formula predict cloud formation

Continued from page 1

Morse found. More pronounced ion clouds formed on the side of the racetrack closet to the anode and gas manifold. These results suggest that electric forces or local pressure differentials might be a factor.

The target material properties and amount of surface contamination also influence cloud formation: materials that yield more secondary electrons produce more ion clouds. Also, stronger magnetic fields increase ionization clouds.

Using modeling software, Morse was able to theorize the electric forces that determine the amount of ion cloud formation and come up with a model and formula that will predict them.

While there are usually trade offs with PVD coating, this methodology can be used to understand and adjust process parameters in some cases to reduce or eliminate the side effects from the ionization clouds.

Continued on page 4

New products...

Swing Cathode™ and MC end block available in compact versions

Sputtering Components' popular Swing Cathode™ and MC end block are now both available in compact designs.

The new **CM Swing Cathode™** has a smaller footprint, which allows for more flexibly in vacuum chamber design and for more cathodes in a system. It was especially developed to serve the needs of the semiconductor market as well as segments of the display and decorative coatings markets, said **Chaffee Tran**, New Business Development Manager at SCI.

cMC end block

"The adoption of this technology will help to drive the reduction in packaging costs in processing and miniaturization of electronic components."

Used with cylindrical targets and static substrates, Swing Cathodes™ have a magnetron with a programmable swing motion. The magnetron rotates from side to side independently of the target rotation, making Swing Cathodes™ ideal for 3D part coating.

Cost reductions with the Swing Cathode™ are due to increased uptime because the cylindrical target used requires fewer target changes and allows for faster target changes when compared to planar targets. Furthermore, deposition rates can be higher due to more efficient cooling, and yield is better because particle generation is less. There is also a cost savings related to target utilization and capital expense as substrate sizes begin to scale beyond 1 m.

The CM Swing Cathode™ has a cantilever capability to support 80-mm-ID targets as long as 1 m and 125-mm-ID targets up to 0.65 m. Non-proprietary targets can be used, allowing more sourcing choices.

Similar to its big brothers, the SM Swing Cathode™ and the MM Swing Cathode™, the new CM Swing Cathode™ uses an end block that mounts on the vacuum chamber exterior. All utilities remain attached for a quick and easy target changeover.

For use with Swing Cathodes™, SCI's Swing-DUO™ (Dynamic Uniformity Optimization) software simulates and optimizes the motion profile used to control SCI magnet bar movement.

CM Swing™

The new **cMC end block** is designed for retrofit from other manufactures' compact end blocks. For mounting inside the vacuum chamber, the cMC has a width about 20 percent thinner than SCI's MC while keeping the same power rating and ability to handle targets up to 2500 mm long.

Both the CM Swing Cathode™ and the cMC end block have SCI's patented brushless power delivery system and patented water fill/drain feature. The brushless design eliminates brush dust and the need to replace brushes while the fill/drain feature further decreases the time required to change targets and keeps the coater dry during target changes.

Both new products also have long-life rotary seals. They are designed for quick and easy in-house maintenance and never have to be sent back to the factory for overhaul or repair.

For more information about how the CM Swing Cathode™ or the cMC end block can improve your thin film coating process, please contact us or visit the Sputtering Components website: www.sputteringcomponents.com.

More than 70 attend Robeko workshop

More than 70 attendees learned from a dozen sessions at Robeko's third biennial in-house exhibition and technical workshop "Plasma Technology" September 12-14.

Robeko is Sputtering Components' European distributor.

"Many of the guests were here for the first time and were also new or future customers," said Rolf Schäfer of Robeko.

The event, which was held in Münchweiler, Germany, offered a platform for informal exchange with experts in the field. Day one featured hands-on product demonstrations while day two included training about using and maintaining SCI end blocks and magnet bars. Sputtering Components technical experts were on hand to assist. Day three included more demonstrations at the Robeko facility in Münchweiler.

Fraunhofer's Holger Gerdes was one of the presenters at Robeko's Plasma Technology workshop.

Robeko plans to have another workshop in 2019.

SCI to participate in two fall exhibitions

A pair of exhibitions round out this year's busy conference and exhibition schedule for Sputtering Components.

The Association of International Metallizers, Coaters, and Laminators (AIMCAL) R2R Conference in Tampa, Florida will be a stop for SCI.

The conference, runs from October 15-18. Moved from Naples after Hurricane Irma, the event will be held at the Saddlebrook Resort and Spa.

Recently re-named, this annual event has been a champion of roll to roll processing and the converting industry for many years.

This year, the Society of Plastics Engineers' FlexPackCon Conference will join the AIMCAL R2R Conference. A single registration provides full access to both.

Presentations on web coating and laminating, vacuum web coating, web handling and winding, adhesives and coatings, market overviews and plenary keynote addresses highlight a packed agenda at the AIMCAL conference.

Leading consultants, academia and OEMs will share best practices and new research and technology. SCI will be among the more than 80 tabletop exhibitors.

Sputtering Component's European distributor Robeko will be participating in the V2017 exhibition in Dresden, Germany, October 24-26.

The educational event for scientists and engineers in the vacuum coating industry is held every two years. In a new location this fall, the exhibition will take place at DGUV Academy in Dresden.

Robeko has been participating in the V exhibition for many years and is a platinum sponsor this year. The company will exhibit in booth 22.

White paper is available on Sputtering Components website

Continued from page 2

For more about Morse's study, please refer to SCI's white paper: "Ionization cloud formation in rotary cathode plasma confinement" at www.sputteringcomponents.com.

Works cited:

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Janes, G. S. and R. S. Lowder, "Anomalous electron diffusion and ion acceleration in a low-density plasma," Phys. Fluids, vol. 9, no. 6, p. 1115, 1966.