

Enhanced Plasma Containment for Inline Sputtering Systems

Maximize process control, film quality, and uptime with your PEII power supply's CEX feature

Products

PEII Series Low-Frequency Power Supplies

Applications

Inline reactive sputtering systems for FPD, solar, and architectural glass manufacturing

Who Benefits

System designers and process engineers

Utilizing the PEII low-frequency power supply's unique CEX capability to create the alternating cathode arrangement illustrated in Figure 2 below significantly improves process control, film quality, and uptime by containing the plasma more efficiently and precisely. Specifically, efficient plasma containment alleviates cathode crosstalk, a potentially debilitating phenomenon that can lead to target damage, substrate arcing, and substrate damage. It may also lead to eventual power supply damage. In addition, crosstalk may prevent you from reaching the desired power level, which decreases throughput.

This application note illustrates a cathode arrangement that enables you to take full advantage of the benefits of CEX. When setting up a system such as the inline system pictured in Figure 1, be certain also to follow the CEX setup instructions in your PEII power supply user manual.

Cathode Crosstalk

Larger substrates, such as those frequently used in FPD and architectural glass manufacturing, can require a dozen or more cathodes (targets) per chamber. In order to fit into a single chamber, the space between cathodes must shrink. When closely-spaced targets are not synchronized using a feature such as the PEII power supply's CEX, they can be at different potentials, causing them to interfere with one another. This interference is called crosstalk and can lead to the serious process, film, and equipment problems described above.

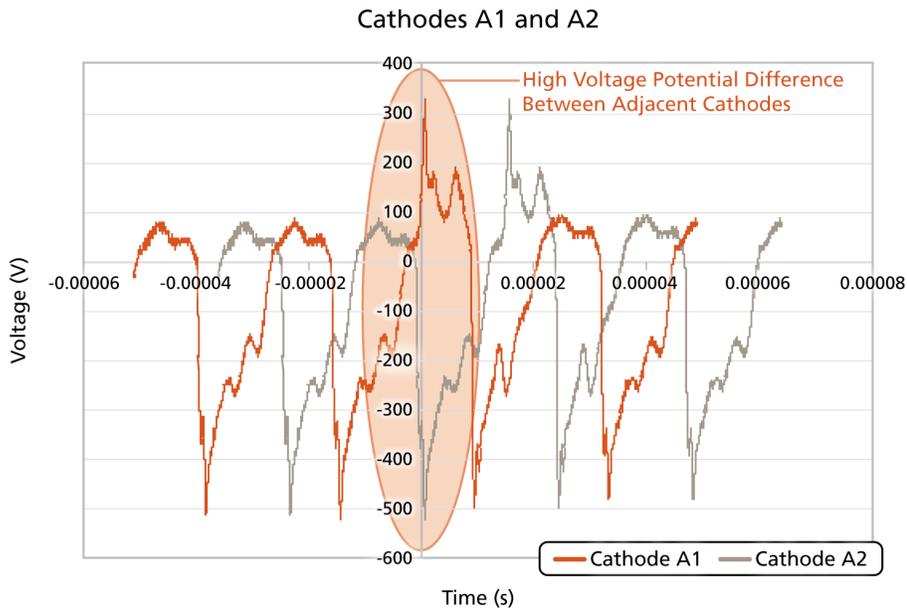


Figure 1. This scope trace shows poor synchronization and high potential difference between adjacent cathodes, a phenomenon that can be alleviated by using the PEII power supply's CEX feature to create the cathode setup shown in Figure 2

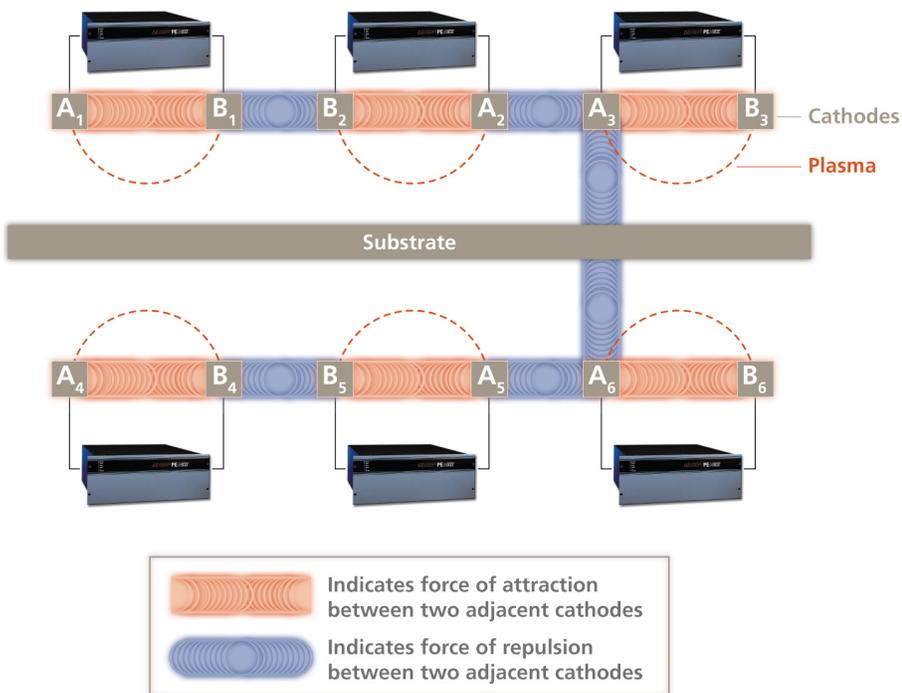


Figure 2. The PEII series' CEX (*common exciter*, or phase synchronization) feature enables precise plasma localization with this alternating cathode arrangement

In the arrangement shown in Figure 2, all cathodes labeled “A” are sputtering while the cathodes labeled “B” are positive polarity and functioning as the anode. Cathode A3 can couple only to cathode B3 because B3 is the only opposite-polarity electrode adjacent to A3. Furthermore, cathode A3 can never couple to cathode A2 because both are “A” cathodes and therefore have similar potential and are at the same polarity. Cathode A3 also can never couple to cathode A6 on the other side of the substrate for the same reason. On the other hand, cathode B3 is always at the opposite polarity of cathode A3, which promotes plasma formation and localization between them.

Using CEX, the PEII power supplies shown above are synchronized so that at any given point in time, the polarity of all A cathodes is equal. That is, all A cathodes are at the same phase and polarity. Likewise, all B cathodes are in phase and have the same polarity. Further, all A cathodes are always at the opposite polarity of all B cathodes. Therefore, two adjacent A cathodes constantly repel each other, inhibiting plasma formation between them. The same phenomenon occurs for two adjacent B cathodes, as well as for two cathodes of the same polarity on opposite sides of the substrate. The largest potential difference is between the A and B electrodes that are adjacent and connected to the same power supply. This promotes plasma formation and localization in these areas.

For more information on PELL low-frequency power supplies, visit:
www.advanced-energy.com/en/PELL_Series.html

To view AE's comprehensive power systems portfolio, visit:
www.advanced-energy.com/en/Power_Systems.html

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Specifications are subject to change without notice.



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