Hybrid Process for Depositing Electrochromatic Coating

Summary
A hybrid process for the production of ECD’s (electrochromatic devices) using plasma enhanced chemical vapor deposition (CVD) and other coating techniques has been designed for the optimal use of coating resources.

Overview
Air Products is offering for license a patent relating to the hybrid process to produce multilayer ECD’s. Electrochromic materials have the ability to change their optical properties when stimulated by voltage. Electrochromic materials are important to the architectural and automotive markets, especially for use in displays, rear-view mirrors, and smart windows. Typically, ECD’s are manufactured using a single deposition technology, mainly magnetron sputtering. The deposition rate by sputtering greatly depends upon the material that is being deposited. Depending upon the material used for sputtering the process can be efficient or inefficient. For example, it is inefficient and time consuming to use the sputtering process for depositing ion conducting layer as well as working electrode and ion storage electrode layers in multilayer ECD’s. Since sputtering is not efficient for depositing some of the layers in multilayer ECD’s, a hybrid process for the production of ECD’s has been designed to optimize coating resources. Plasma CVD is a coating technique that compliments the sputtering process, and is used to deposit layers that are inefficient to deposit by sputtering in multilayer ECD’s. The plasma CVD process costs are dominated by raw materials, while the magnetron sputtering process costs are dominated by labor and depreciation. In order to create a process savings it is optimal to coat the multilayer ECD’s using a combination of magnetron sputtering and plasma CVD. There are also other secondary deposition techniques that can be combined with the plasma CVD process besides magnetron sputtering. These secondary deposition techniques include: ion beam evaporation, thermal evaporation, e-beam evaporation, and thermal CVD performed under either atmospheric pressure or vacuum. The secondary deposition techniques are preferably used for depositing the layers of the ECD that are easy to deposit by their respective techniques.

Benefits:
- Improves efficiency of manufacturing ECD’s
- Optimizes deposition of coating layers
- Reduces overall cost

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**Stage of Development:**
An economic analysis study has been conducted by Air Products and Chemicals with an outside partner. The economic study predicted that on similar sized systems plasma CVD can produce electrochromatic tungsten trioxide (WO$_3$) for as little as one-third the cost, and have 10 times the annual production capacity of just using magnetron sputtering. The study also details the economic benefits of using a hybrid process for the production of ECD’s.

**Also Offered:**
Technology transfer assistance may be provided with a license.

**Availability:**
All serious inquiries for license will be considered.

For more information on licensing this technology contact:

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