



# MOXIE-S: Scanning Metal Oxide Electroplating Equipment for Substrates with Surface Conductivity

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## Technology

MOXIE-S is a first of its kind electrochemical deposition tool designed for application of metal oxide coatings on substrates with surface electrical conductivity including but not limited to ***n<sup>-</sup> or p<sup>+</sup> type silicon wafers***, metals such as ***nickel, silver, copper etc.*** as well as dielectric substrates with conductive surface coatings such as ITO, FTO or metal coated glass or polymer, polymers with conductive surface etc).

MOXIE-S can be used for deposition of a wide variety of metal oxide coatings including but not limited to ***ZnO, Al<sub>2</sub>O<sub>3</sub>, In<sub>2</sub>O<sub>3</sub>, CdO, Y<sub>2</sub>O<sub>3</sub>, WO<sub>3</sub>, ZrO<sub>2</sub>, and SnO<sub>2</sub>.***

MOXIE-S is designed for in-line sample processing with maximum sample width of 30cm and is perfectly suited for laboratory level deposition of metal oxide coatings on both rigid as well as flexible substrates.

MOXIE-S is further unique in its ability to deposit metal oxide coatings on a single side of the substrate without any masking.

## Applications

MOXIE-S can be effectively used as an R&D metal oxide deposition tool in a wide variety of technology development and research applications including but not limited to the following:

- Index matching films for improved transmission
- Antireflective optically transparent coating with adjustable values of reflection and refractive index
- Planarization of coated surface, roughness reduction of conductive surface
- Surface passivation coatings for semiconductor devices

- Optical Masking of patterned integrated circuits with required index matching values
- Enabling new device architectures
- In-line coating
- Suitable for “cathodic” electrochromic oxides deposition including W, Mo, Ti or Nb oxide films as well as “anodic” electrochromic oxides deposition including Ni or Ir oxides with increased coloration efficiency
- Development and testing of new materials with advanced conductive, dielectric, electrochromic and other properties

## Features

MOXIE-S has a number of unique features including the following:

- Capable of depositing metal oxide films on a wide variety of substrates without any substantial adjustments to the equipment hardware.
- Single side deposition without masking
- All parameters of coating process are adjustable including deposition process temperature, time and chemistry
- Deposited film thickness can be easily adjusted with +/- 2% uniformity over a wide range up to 200nm and greater
- Deposition process can be adjusted to provide for desired levels of porosity and refractive index of metal oxide coatings
- Substrate dimensions up to 30cmx30cm
- Compatible with both Organic or Aqueous electrolytes
- Applicable for deposition of a wide range of metal oxide films including ZnO, Al<sub>2</sub>O<sub>3</sub>, In<sub>2</sub>O<sub>3</sub>, CdO, Y<sub>2</sub>O<sub>3</sub>, WO<sub>3</sub>, ZrO<sub>2</sub>, SnO<sub>2</sub> etc.

- “Liquid only” electrical contact to deposition surface for complete coating coverage
- Galvanostatic process with a wide range of operating electrical currents tunable to your specific electrolyte and metal oxide system (0.5mA/cm<sup>2</sup> up to 1A/cm<sup>2</sup>) *Note: specific current range subject to power supply used.*
- Linear substrate speed when passing through MOXIE-S deposition window can be as high as 100cm per minute

## Advantages

MOXIE-S is a direct replacement of a more traditional PVD, CVD, PECVD and/or APCVD-based approach to metal oxide film deposition. As a PVD replacement MOXIE-S offers a number of advantages:

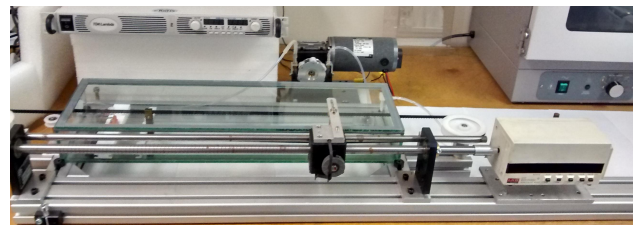
- MOXIE-S is an atmospheric pressure deposition tool. As a result MOXIE-S is a lot simpler, cheaper and easier to both install and operate
- MOXIE-S deposition process takes place at ambient temperature and results in deposition of metal oxide films with crystalline structure. As a result MOXIE-S does not generally require post-deposition high temperature annealing and is well suited for processing of temperature sensitive substrates.
- MOXIE-S utilizes wet pre-clean process for incoming substrates. This process does NOT result in any damage to the substrate surface prior to deposition.

- MOXIE-S utilizes over 98% of deposition materials is capable of deposition chemistry changes without any equipment adjustments or downtime.
- MOXIE-S has very low power consumption that is as low as 0.05-0.07Wh/substrate in case of deposition on silicon wafers.

## Benefits

Key benefits of using MOXIE-S as a part of laboratory research include:

- Accelerated technology development cycle due to simple, flexible and low cost approach to metal oxide deposition offered by MOXIE-S R&D equipment
- Ability to deposit metal oxide coatings on a single side of a substrate without substrate masking and subsequent mask removal
- Low deposition process temperature broadens the universe of substrate materials as well as simplifies integration with low temperature earlier processing steps
- Lack of substrate damage during the wet pre-clean process enables higher level optical properties



MOXIE-S in-line electroplating tool

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