DENTON VACUUM
Enabling Innovation

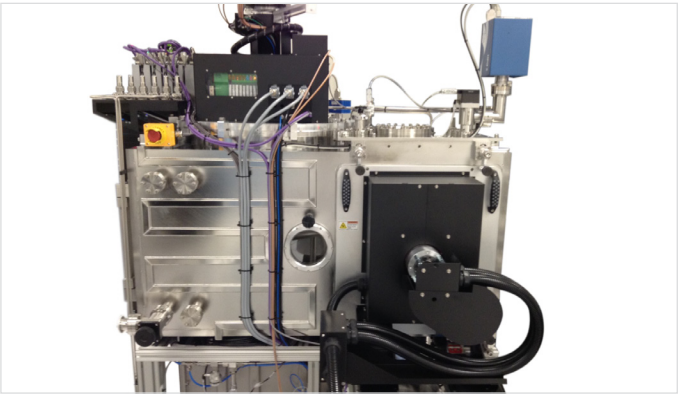
INFINITY BIASED TARGET SPUTTERING SYSTEM

TECHNICAL SPECIFICATION SHEET

Patented biased target sputtering technology provides higher performance than traditional ion beam sputtering.

BENEFITS INCLUDE:

- Wide range of process pressures
- Control of adatom energies
- Excellent uniformity and repeatability
- Low defect and low contamination
- Atomically engineered thin film interfaces and surfaces
- Able to accommodate multiple substrate sizes up to 8"



Infinity Biased Target Sputtering System

FEATURES	BENEFITS
Biased target sputtering	Independent control of ion currents and energies, interface engineering
Low process pressure	Large mean free path Collimation Dense films
Electronic shuttering	Instantaneous start/stop Repeatability
Compatible with front-end options	Easily scalable to meet throughput demands
Automation software	Enhanced process control
Short MTTR/Long MTBF	High system uptime and ease of maintenance

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SYSTEM OVERVIEW

Denton Vacuum's Infinity Biased Target Sputtering System is uniquely suited to demanding applications requiring atomically engineered thin films and interfaces. It offers a large range of process pressures, control of adatom energies and excellent uniformity and repeatability. High performance multilayer devices such as giant magnetoresistive multilayers, optical interference filters and gate dielectric stacks are particularly well suited to BTS.

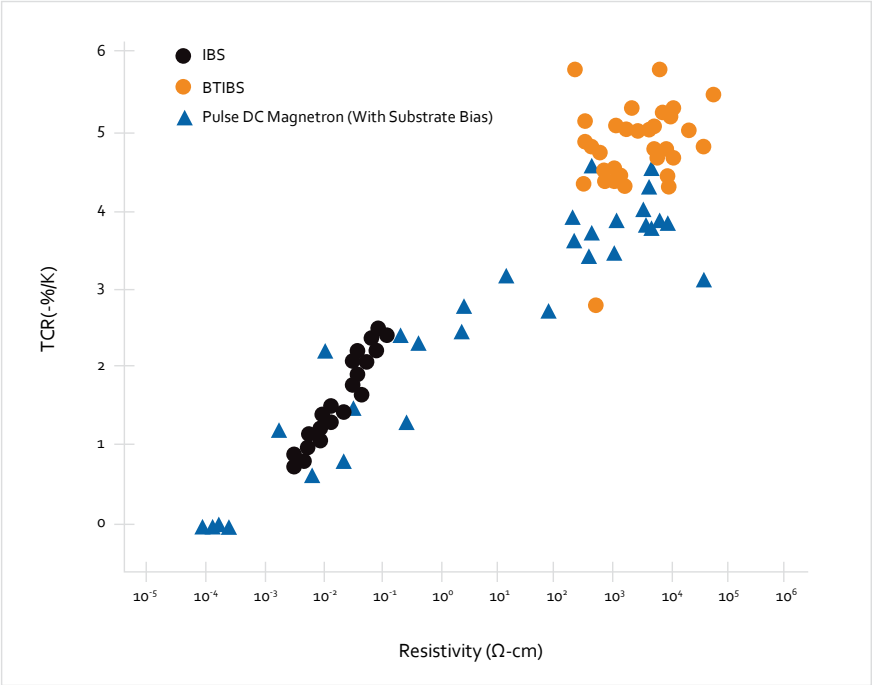
In BTS, a low energy ion source (typically of the end-Hall or closed-drift Hall type) is directed at a negatively biased sputtering target. The maximum energy (typically < 30 eV) of the ions is less than the sputter threshold of the vacuum system materials. No effort is made to capture all of the ions on the target because ions that miss the target do not generate unwanted sputtering. In practice, the ion beam can be much broader than the target to improve illumination uniformity. A plasma sheath develops at the surface of the negatively biased target that accelerates positive ions entering the sheath toward the target to produce sputtering.

Because the sheath is very small (~ 2 mm) compared to the spacing between the ion source and target, the target bias has no substantial effect on the ion trajectories from source to target. Hence, for constant source operation, the illumination profile and the ion current reaching the target are nearly independent of the target voltage. A grounded shield surrounds the target to prevent undesired sputtering of the target mounting hardware that is also biased. DC, RF or pulsed DC target bias is used depending on the target material and desired process. A large range of target voltages (~100 to 2000 V) can be used while maintaining reasonable deposition rates. The selection of the target voltage, controls the adatom energies, which enables tuning of the atomic-scale mixing at thin film interfaces and the overall roughness of the growing film. In addition, the ion source is capable of operating over a broad range of process pressures (~10^{-4} to 5x10^{-3} Torr), allowing control of the adatom scattering from the background gas.

A second, low energy ion source (an assist source) is directed at the substrate to modify the properties of the growing film. Non-reactive assisting ion energies of order 5-15 eV are useful in creating smooth films. Reactive assist ions can be used (e.g., ions of O_2 and N_2) to create dielectric films from metallic targets. This source can also be used to etch, clean and modify surfaces prior to deposition.

APPLICATIONS:

- Precision optics (HAMR, EUV)
- VCSEL anti-reflective coatings
- Next-gen VOx microbolometers
- High-efficiency solar cells
- Spin valves for magnetic recording



See footnote for reference

CONFIGURATION OPTIONS

BIASED TARGET MODULE	Assist Source for Pre-clean and Densification	In-situ Thickness Control	Residual Gas Analyzer
FRONT ENDS	Single Wafer Load Lock	Cassette Load Lock	Cluster Tool Front End

Jin, Y., Basantani, H. A., Ozcelik, A., Jackson, T.N., and Horn, M.W., "High Resistivity and High TCR Vanadium Oxide Thin Films For Infrared Imaging Preparedby Bias Target Ion Beam Deposition", SPIE (2013).

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