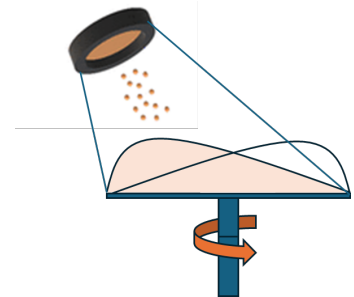


Off-axis Planar vs Confocal Magnetron Configuration

Confocal Magnetron Sputtering

In this configuration, multiple magnetron sources are angled towards a common focal point where the substrate is positioned. This setup allows for uniform deposition and is particularly useful for co-sputtering different materials.



Benefits:

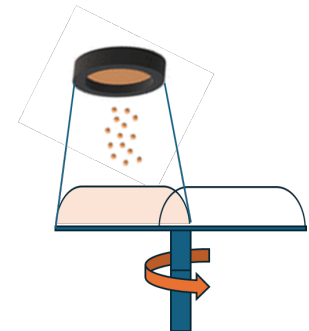
- Better step coverage: Due to the angled deposition flux, it's better for coating 3D surfaces or features.
- Multi-target flexibility: Great for co-sputtering from different materials (e.g., alloys, graded layers).
- Improved compositional control: Because targets aim at a shared area, the composition can be tuned by adjusting the power to each source.
- Compact setup: Useful for small-area or research-scale systems.

Drawbacks:

- Limited substrate size: Uniformity drops off for larger areas unless you compensate with complex motion.
- Angle of incidence issues: May lead to anisotropic film growth or shadowing on high-aspect-ratio features.
- Typically, the magnetrons are next to each other and towards the center. For larger size magnetrons it becomes more difficult to get good uniformity

Planar Off-Axis Magnetron Sputtering

In the planar off-axis configuration, the magnetron target is positioned parallel to the substrate but offset from it. This arrangement reduces direct bombardment of the substrate by high-energy particles, leading to smoother films with fewer defects.



Benefits:

- Reduced particle contamination: Since the substrate is off-axis, fewer high-energy particles and target re-deposition reach it — especially important for sensitive films.
- Better film quality: Lower energy bombardment can mean smoother films with fewer defects.
- Lower substrate heating: Good for temperature-sensitive substrates like polymers.
- Directionality control: Useful for tuning film growth dynamics.
- Typically allows larger distance between magnetron and the substrate so more room for optimization.
- Magnetron can be tilted with a fixed angle. In case the substrate must be tilted, there is an optimized off axis position for any tilt giving more degree of freedom for uniform depositions and for different size magnetrons

Drawbacks:

- Lower deposition rate: Less direct sputter flux hitting the substrate.
- Complex geometry: Needs precise design to get good angular deposition and uniformity.
- Less efficient material usage: More sputtered atoms may miss the substrate which can be corrected with proper tilt and target substrate distance

Summary:

- ✓ Use confocal if you want flexibility, good coverage, and high deposition rates, especially for co-sputtering materials.
- ✓ Use planar off-axis if you're targeting high-purity, low-defect films on temperature-sensitive substrates or want to avoid re-deposition and energetic particle damage.