Increasing Low-Melting-Point Target Utilization:
A Power Systems Route to Operating Cost Reduction

Introduction
Target material is a major expense in large-area thin-film deposition systems. Using a dual-magnetron sputtering system has proven to greatly reduce this expense by extending the usable life of low-melting-point targets, in particular, Sn.

The “old iron” AC power supplies of a coating company were associated with frequent, massive arcing that severely damaged rotatable targets to such a degree that they were deemed unusable. Out of the box with factory default settings, the 60 kW AMS/DMS delivery system was tested using the worst of the damaged targets. Due to rapid, sensitive arc detection and handling, the “unusable” targets ran at a very high set point, immediately creating quality product and extending the targets’ production lives for four months. As an added benefit, target utilization had been extended, enabling the target material to go as low as 2 mm thickness, while previously, the coating firm had to replace targets at 5 mm.

This paper details the coating setup and operation, presents photos of the damaged targets before and after the coating process, and describes potential cost advantages for coating firms.
The Problem
A coating company’s AC supplies were consistently causing blowouts on their tin targets, rendering them unusable usually due to frequent massive arcing. This company had a “bone pile” of tin targets they had deemed unusable. Figures 1 through 5, below, show examples of these targets. Some targets were damaged even more severely than pictured here.

Solution: Part One
The company replaced an “old iron” AC power supply with a 60 kW AE® Ascent® AMS/DMS power delivery system. After setting up, they decided to put their new system to the test. They chose the most damaged targets they could find quickly to see if the system could handle them without breaking. No one thought these targets were usable for production. They initiated sputtering with the 60 kW stack at 55+ kW.

Remarkably, the targets ran at the high setpoint and immediately made product. The AE stack ran perfectly out of the box on severely damaged tin targets with no engineering intervention.

Furthermore, the targets continued in service for four additional months.

Damaged Targets Before Use with the AMS/DMS System
The photos below (Figures 1 to 6) show the tin targets before they were used with the AMS/DMS stack. It’s highly unlikely that anyone would have considered these usable. The damage is extreme—the “mouse bites” had turned into “dog bites” on the ends of the tin material.
Figures 1 to 6. Some of the tin targets *before* they were used with the AE AMS/DMS stack.
Targets After Four Months of Runtime with AMS/DMS System

The following pictures (Figures 7 to 10) are the same targets shown above after *four months* of runtime. The company produced quality product with these severely damaged targets using the AMS/DMS stack at factory default settings. Notice that the holes and repairs are still visible on the targets.
The Solution: Part Two

After the success of the initial test, the coating company tried targets that were even more dramatically damaged. The ends of these eight-inch diameter targets were extremely blown out, with severe “dog bites.” For all practical purposes, they were unusable.

The coater put the targets shown below (Figures 11 to 13) into service with the AMS/DMS stack to see if they might be at all usable for production.

Results: The targets were used in production for four weeks at 55+ kW, making good films.

As an unexpected bonus, the Ascent DMS auto-balancing feature enabled a dramatic increase in target material utilization. The coater operators usually run the targets down to 5 mm thickness before considering them spent and replacing them. The auto-balancing feature enabled them to continue production to as low as 2 mm thickness, which can equate to an additional campaign on the targets.
Figures 11 to 13. Some of the even more dramatically damaged tin targets *before* they were used with the AMS/DMS stack.
The pictures below show the targets after four weeks of production.
Conclusion

This coater realized significant savings using an AMS/DMS power delivery system to:

- Reclaim targets that were previously deemed unusable
- More fully utilize target material by sputtering down to 2 mm instead of 5 mm

This solution offers an important option for companies looking to increase profits by significantly reducing target material costs. Though each process is unique, the potential return on investment is highly compelling.