

APPLICATION NOTE

Distribution Uniformity Guidelines for SunSource™ Linear Sputtering Sources Used in “Pass-By” or Rotating Drum Systems

Summary

Distribution uniformity requirements across the substrate surface determine the required length, assuming a simple “pass-by” arrangement common on web coaters, inline systems or rotating drum arrangements.

Nearly the only downside to the use of high utilization sputtering sources is that the distribution uniformity at the ends of the source drops off much more quickly than that for more conventional magnetrons exhibiting v-groove patterns. This is due to the fact that a proportionately higher contribution of low-angle material is made from the wider erosion profile. Consequently, SunSource™ cathodes, in most applications, must be longer by several inches.

Following, are some simplistic rules of thumb for estimating the necessary length. Keep in mind that factors like source-to-substrate distance, pressure, target material and means of deposition (reactive, AC, pulsed DC, RF, etc.) can strongly influence your final decision. The numbers presented below assume a nominal 1 – 3 mTorr Ar operating pressure. Different conditions and materials yield different results under the same physical geometries and spacing. They also assume the use of sources at least 15” (381 mm) and longer. The end contributions of the turnarounds at the ends of short sources make a disproportionately large contribution to poor distribution uniformity. An 8” (203,2 mm) long source begins to act very much like an 8” round source as the linear portion of the erosion area that produces good +/- 1-2% distribution uniformity is only about 2” (50,8 mm) long.

Assuming a 2” (50,8 mm) source-substrate distance:

- ± 10% thickness distribution (aka 90% distribution) - Add 6” (152,4 mm) to substrate width
- ± 5% thickness distribution (aka 95% distribution) - Add 10” (254 mm) to substrate width
- ± 2% thickness distribution (aka 98% distribution) - Add 12” (304,8 mm) to substrate width

Closer source-to-substrate distances yield better distribution uniformity (within the 2” -4” [50,8 mm – 101,6 mm]) distances commonly used in the typical sputtering pressures noted above.

Note that no substrate masking, uniformity masks or other devices have been contemplated in the above, conservative recommendations



Example

For a 60" (1524 mm) wide substrate moving past a 72" (1828,8 mm) long source @ nominal 3 mTorr Ar background pressure, the following results may be expected:

@ 2" (50,8 mm) source-substrate distance = +/- 2% distribution uniformity (aka 98%)

@ 3" (76,2 mm) source-substrate distance = +/-4% distribution uniformity (aka 96%)

@ 4" (101,6 mm) source-substrate distance = +/- 6% distribution uniformity (aka 94%)

How to Contact Us

Materials Science, Inc.
1662 Los Altos Road
San Diego, CA 92109
Main Tel/Fax: (858) 483-3223

General Information: info@msi-pse.com
Sales: sales@msi-pse.com