Comparison of Common Sputtering Targets

The following table maybe useful in making decisions regarding your thin film deposition processes.

Column Two
Density
Maximal theoretical density of each PVD coating material
While density does not necessarily effect a sputtering rate, targets of higher density last longer and possess fewer voids or inclusions and, thus, deposit a better film.

Column Three
Yield
The number represents target atoms ejected from the target per argon ion striking the target with a kinetic energy of 600 ev (an energy level typical for an argon plasma). Magnetic field strength, gas composition and pressure, among other factors affect these yield numbers.

Column Four
Rate
These numbers reflect film deposition rates at maximum power density (i.e. about 250 w/in^2, with direct cooling) and a 4" source to substrate distance. Such rates decrease linearly with lower power levels. With all other factors unchanged, the film deposition rate will:

- Decrease by approximately 25% per inch beyond the 4" source to substrate distance.
- Increase by approximately 35% per inch closer than the 4" substrate distance.

The following sputtering yield rates are provided as a comparison. Specific thin film deposition rates will vary based upon PVD coating system design and process parameters.

Target Material	Density (g/cc)	Yield @ 600 ev	Rate* (Å/sec)
Ag	10.5	3.4	380
Al	2.7	1.2	170
$Al_{98}Cu_2$	2.82		170
Al_2O_3	3.96		40
$Al_{99}Si_1$	2.66		160
Au	19.31	2.8	320
Be	1.85	0.8	100
B_4C	2.52		20
BN	2.25		20
C	2.25	0.2	20
Co	8.9	1.4	190
Cr	7.2	1.3	180
Cu	8.92	2.3	320
Fe	7.86	1.3	180
Ge	5.35	1.2	160
Hf	13.31	0.8	110
In	7.3		800
In_2O_3	7.18		20
ITO	7.1		20
Ir	22.42	1.2	135

Target Material	Density (g/cc)	Yield @ 600 ev	Rate* (Å/sec)
Mg	1.74	1.4	200
MgO	3.58		20
Mn	7.2	1.3	180
Mo	10.2	0.9	120
MoS_2	4.8		40
$MoSi_2$	6.31		110
Nb	8.57	0.6	80
Ni	8.9	1.5	190
$Ni_{81}Fe_{19}$	8.8		110
$Ni_{80}Cr_{20}$	8.5		140
$Ni_{93}V_7$	8.6		100
Os	22.48	0.9	120
Pd	12.02	2.4	270
Pt	21.45	1.6	205
Re	20.53	0.9	120
Rh	12.4	1.5	190
Ru	12.3	1.3	180
Si	2.33	0.5	80
SiC	3.22		50
SiO_2	2.63		70
Si_3N_4	3.44		40

Target Material	Density (g/cc)	Yield @ 600 ev	Rate* (Å/sec)
Sn	5.75		800
SnO	6.45		20
Ta	16.6	0.6	85
TaN	16.3		40
Ta_2O_5	8.2		40
Th	11.7	0.7	85
Ti	4.5	0.6	80
TiN	5.22		40
TiO_2	4.26		40
U	19.05	1	155
V	5.96	0.7	85
W	19.35	0.6	80
$W_{90}Ti_{10}$	14.6		80
WC	15.63		50
Y	4.47	0.6	85
YBCO	5.41		10
Zn	7.14		340
ZnO	5.61		40
ZnS	3.98		10
Zr	6.49	0.7	85
ZrO_2	5.6		40