


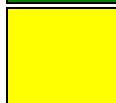
Material & Coating Process Compatibility Guide

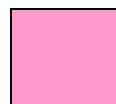
Material Description	Common Designation	Typical Application	Typical Hardness	"Coat-ability"			
				PVD	CVD	TD	DCD
Air Hardened	A6	Form Tools, Stamping	58 - 60 Rc	Green	Red	Yellow	Green
Air Hardened	A2, A2S	Form Tools, Stamping	58 - 60 Rc	Green	Yellow	Green	Green
Oil/Water Hardened	O1, O6, W1	Draw & Press Tools	58 - 62 Rc	Green	Red	Red	Green
H-Series	H13, H21, H26	Hot Work	52 - 58 Rc	Green	Green	Green	Green
M-Series (HSS & HSCo)	M2, M4, M42	Cutting Tools	60 - 65 Rc	Green	Green	Green	Green
Specialty Steel	CPM 3V, 9V, 10V	Stamping & Forming	59 - 64 Rc	Green	Green	Green	Green
Specialty Steel	Vanadis 4, 10	Stamping & Forming	59 - 64 Rc	Green	Green	Green	Green
Specialty Steel	DC-53	Stamping & Forming	58 - 62 Rc	Green	Green	Green	Green
T-Series (HSS & HSCo)	T1, T15	Cutting Tools	60 - 66 Rc	Green	Green	Green	Green
P-Series	P20	Molds, General	25 - 30 Rc	Green	Red	Yellow	Green
S-Series	S2, S5, S7	Heading Tools	56 - 58 Rc	Green	Red	Green	Green
D-Series	D2, D3, D6	Press & Form Tools	58 - 62 Rc	Green	Green	Green	Green
Carbide	Tungsten Carbide	Inserts, Dies/Punches	72 - 82 Rc	Green	Green	Yellow	Green
Martensitic PH SS	17-4, 13-8, 15-5, 465	Molds, Medical, General	44 - 50 Rc	Green	Green	Green	Green
400 Series SS	410, 416, 420, 440	Molds, General	40 - 60 Rc	Green	Yellow	Green	Green
300 Series SS	302, 303, 304, 316	Corrosion Protection	Various	Green	Red	Red	Green
Cold Rolled Steel	1008, 1010, 1018	General	71-110 HRB**	Yellow	Red	Red	Green
Carbon Steel	1045, 1065, 12L14	General	90-210 HRB**	Yellow	Red	Red	Green
Alloy Steel	4140, 4340, 8620, 9310	Molds, Gears, General	35 - 45 Rc**	Yellow	Red	Yellow	Green
Medium Carbon Steel	NAK 55	Molds	35 - 40 Rc**	Yellow	Red	Yellow	Green
High Carbon, Low Alloy	52100	Bearings	60 - 63 Rc	Yellow	Red	Yellow	Green
Aluminum	6061	General Components	Various	Yellow	Red	Red	Green
Beryllium Copper	molMAX	Molds, General	35 - 45 Rc	Yellow	Red	Red	Green
High Nickel Alloys	Inconel 625 & 718, Invar	Aerospace, General	80-371 HRB	Green	Yellow	Yellow	Green
Titanium	Ti-6AL-4V	Medical, General	xxx	Green	Red	Red	Green
Brass *	xxx	Decorative	xxx	Yellow	Red	Red	Green
Al/Zn/Mg Castings *	xxx	General Components	xxx	Yellow	Red	Red	Green
ABS Plastic*	xxx	Decorative	xxx	Yellow	Red	Red	Green


* - Can be coated only after being chrome or nickel plated

** - these steels will often be case hardened to increase surface hardness

 A very good material for the indicated coating process.

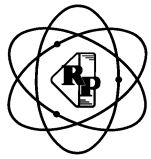
 An acceptable material for the indicated process; however, there may be some special process modifications required, such as temperature.

 Material can be coated with the indicated process; however, possible material stability or composition issues may result. Not recommended.

 This material is absolutely inappropriate for the indicated process: do not attempt.

Please Note the Following:

1. This is only a sample listing of materials and should not be considered definitive. Information has been generalized – please contact a Richter Precision Inc. representative regarding your specific application.
2. All parts, regardless of coating process, should be sent to us already heat treated to your required hardness. In the case of the CVD and TD processes, parts will be annealed during coating and then re-heat treated afterward. However, being hardened prior to coating will reduce stresses and distortion during coating.
3. When considering the PVD process, whenever appropriate for the material, we recommend that final draws be > 800° F in order to ensure that no annealing and/or distortion will occur.



RICHTER PRECISION, INC.

Comparison of Coating Process Characteristics

Process Characteristics	PVD Physical Vapor Deposition	CVD Chemical Vapor Deposition	TD or TRD Thermoreactive Diffusion	DCD Dynamic Compound Deposition
Method	Processed in a vacuum chamber (10 ⁻² to 10 ⁻⁴ Torr)	Processed in atmospheric or vacuum reactor	Processed in an elemental salt bath	Processed in a proprietary vessel
Temperature	Low process temperature (320° to 800° F)	High process temperature (1925°F)	High process temperature (1875°F)	Low process temperature (100° F)
Deposition Limitations	Line of sight process	Coats wherever gases contact the tool surface	Coats wherever reactive bath contacts the substrate	Coats wherever coating media contacts the surface
Bond Type	Physical	Chemical & metallurgical	Diffusion	Mechano-chemical
Average Thickness	1-5 μm, or .00004-.0002"	4-12 μm, or .00016-.00047"	6-9 μm, or .00024-.00035"	0.5-2 μm, or .00002"- .00008"
Material Limitations	Suitable for a wide range of substrates	More limited range of substrates than for PVD	More limited than for PVD; less limited than for CVD	Suitable for a wide range of substrates
Tolerances	Ideal for closely toleranced components (+/- .0001)	Requires loose tolerances (ex.: +/- .0005 per 1.0" dia.)	Similar to CVD - some materials more stable	Ideal for closely toleranced components (+/- .0001)
Post-Processing	No heat-treating required after coating	Heat-treating required on steel parts	HT required on HSS; tools steels need to be tempered	No heat-treating required after coating
Edge Build-Up	No excessive coating build-up	Requires hone on edges due to thicker coating	Requires hone on edges due to thicker coating	No excessive coating build-up
Surface Finish	Coating generally replicates existing surface finish	Post-coating polish can achieve good finishes	Post-coating polish can achieve good finishes	Coating may have slight matte effect