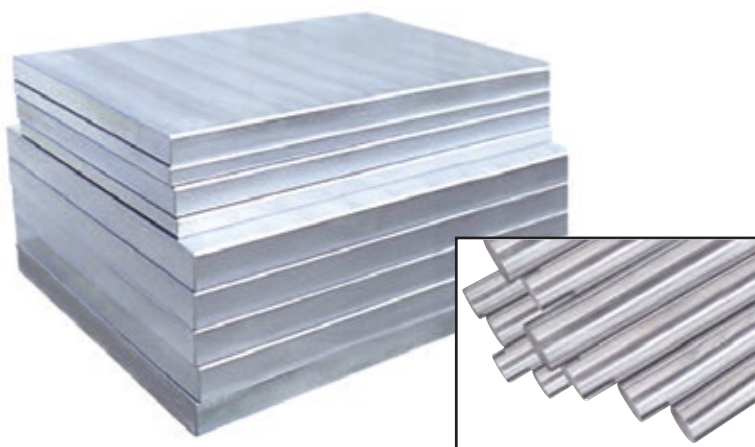


PRECIPITATION HARDENING STAINLESS MOLD STEEL



APPLICATIONS

- Ultimate mold base
- Cavities for plastics & rubber molds
- Stainless mold with corrosion resistance
- Plastic extrusion dies

UltraChem® is a chromium-nickel precipitation-hardening stainless steel, a modified PH alloy grade, which is characterized by:

- Exceptional corrosion resistance
- Uniform hardness in all dimensions
- Excellent compressive strength
- Simple low temperature hardening treatment with minimal dimensional change
- Good weldability

UltraChem is normally supplied in a fully heat treated condition, age hardened to 38 to 42 HRC. Age-hardening has a number of advantages:

- Distortion is virtually eliminated - only a small, predictable shrinkage is experienced (approx. 0.0005 in. per in.)
- Uniform hardness throughout thick sections, with minimum risk of cracking.
- No scaling or decarburization of the part.

UltraChem's excellent corrosion resistance reduces both mold maintenance costs and production costs. Consistently high molding productivity is assured since cooling channels are not subjected to corrosion and loss of cooling efficiency.

UltraChem is recommended for use in long life molds and dies subjected to severe working conditions, including corrosive materials and atmospheres, high stressed and indentation experienced in today's fast cycling molding operations.

Typical Analysis %	C .05	Mn .70 Ni 4.50	S .08 Cu 3.20	Cr 14.75 Nb + Ta .30
Delivery condition	Prehardened to 38-42 RC Hardness is Uniform			
Color code	White			

PROPERTIES

PHYSICAL DATA

Age-hardened to 42 HRC. Data at room elevated temperatures.

Temperature	68°F (20°C)	390°F (200°C)	750°F (400°C)
Density			
kg/m ³	7,800	7,750	7,700
lbs/in ³	0.284	0.282	0.280
Modules of Elasticity			
N/mm ²	196,000	185,000	174,400
psi	28.5 x 10 ⁶	27.0 x 10 ⁶	25.4 x 10 ⁶
Coefficient of Thermal Expansion			
/°C from 20°C	-	10.8 x 10 ⁻⁶	11.7 x 10 ⁻⁶
/°F from 68°F	-	6.0 x 10 ⁻⁶	6.5 x 10 ⁻⁶
Thermal Conductivity			
W/m °C	16.1	18.6	21.5
Btu in (ft ² h°F)	112	129	149
Specific heat			
J/kg °C	460	-	-
Btu/lb°F	0.110	-	-

TENSILE STRENGTH

Typical values. Age hardened condition at 42 HRC.

Testing Temperature 68°F (20°C)	psi	N/mm ²
Tensile Strength	190,000	1310
Yield Strength	175,000	1208
Reduction of Area	50%	
Elongation in 2"	14%	

IMPACT STRENGTH

Typical values. Age hardened condition at 42 HRC.

Testing Temperature 68°F (20°C)	ft/lbs.	joules
Impact Strength	25	30

MACHINING RECOMMENDATIONS

The cutting data below are to be considered as guidelines and may require adjustments based on equipment, selection of cutting tools, etc.

Condition: prehardened approx. 375 HB

Coolant Recommended

TURNING

Cutting data parameter	Turning with carbide		Turning with HSS* Fine turning
	Rough turning	Fine turning	
Cutting speed (v_c) m/min f.p.m.	130-190	190-250	25-28
	430-620	620-820	80-90
Feed (f) mm/r i.p.r.	0.15-0.3	0.0375-0.15	0.0375-0.225
	0.006-0.012	0.0015-0.006	0.0015-0.0075
Depth of cut (a_p) mm inch	2-4	0.5-2	0.5-3
	0.08-0.16	0.02-0.08	0.02-0.1
Carbide designation	ISO	P20-P30	P10-P20
	US	C6-C5	C7-C6
		Coated carbide	Coated carbide or cermet

*HSS = High Speed Steel

MILLING

FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Milling with carbide	
	Rough milling	Fine milling
Cutting speed (v_c) m/min f.p.m.	130-190	190-250
	430-620	620-820
Feed (f_z) mm/tooth in/tooth	0.15-0.3	0.075-0.15
	0.006-0.012	0.003-0.006
Depth of cut (a_p) mm inch	2-5	≤2
	0.08-0.2	≤0.08
Carbide designation	ISO	P20-P40
	US	C6-C5
		Coated carbide
		Coated carbide or cermet

END MILLING

Cutting data parameter	Type of end mill		
	Solid carbide	Carbide indexable insert	HSS
Cutting speed (v_c) m/min f.p.m.	80-120	120-170	35-40 ¹⁾
	260-390	390-560	115-130
Feed (f_z) mm/tooth in/tooth	0.0045-0.15 ²⁾	0.045-0.15 ²⁾	0.0075-0.26 ²⁾
	.00015-0.006 ²⁾	.0015-0.006 ²⁾	.0003-0.0105 ²⁾
Carbide designation		P15-P40	
		C6-C5	

¹⁾ For coated HSS end mill $v_c = 60-66$ m/min (197-217 f.p.m.)

²⁾ Depending on radial depth of cut and cutter diameter

DRILLING

HIGH SPEED STEEL TWIST DRILLS

Drill diameter		Cutting speed (v_c)		Feed (f)	
mm	inch	m/min	f.p.m.	mm/r	i.p.r.
-5	-3/16	17-19*	56-62*	0.03-0.057	0.0015-0.003
5-10	3/16-3/8	17-19*	56-62*	0.057-0.11	0.003-0.006
10-15	3/8-5/8	17-19*	56-62*	0.11-0.14	0.006-0.0075
15-20	5/8-3/4	17-19*	56-62*	0.14-0.17	0.0075-0.01

*For coated HSS drill $v_c = 29-31$ m/min (95-102 f.p.m.)

CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tip ¹⁾
Cutting speed (v_c) m/min f.p.m.	215-240	110-130	70-110
	715-790	360-427	230-360
Feed (f_z) mm/r i.p.r.	0.04-0.11 ²⁾	0.11-0.19 ³⁾	0.11-0.19 ⁴⁾
	0.015-0.045 ²⁾	0.003-0.075 ³⁾	0.0045-0.0075 ³⁾

¹⁾ Drill with replaceable or brazed carbide tip

²⁾ Feed rate for drill diameter 20-40 mm (0.8"-1.6")

³⁾ Feed rate for drill diameter 5-20 mm (0.2"-0.8")

⁴⁾ Feed rate for drill diameter 10-20 mm (0.4"-0.8")

GRINDING

A general grinding wheel recommendation is given below.

Type of grinding	Delivery condition
Face grinding straight wheel	A 46 HV
Face grinding segments	A 36 GV
Cylindrical grinding	A 60 KV
Internal grinding	A 60 JV
Profile grinding	A 120 JV

WELDING

Weld overlays of worn areas and repair welds up to 1" deep can be made on Ultrachem in the aged condition using shielded metal arc welding with W17-4 PH electrodes. In contrast to other die holder block steels no preheating is required to produce sound welds in Ultrachem regardless of its pre-weld condition.

However, welds should be stressed relieved at 900°F for 1 hour per inch of thickness after welding.

SERVICES

Saw cutting, Blanchard grinding up to 120" diameter and Surface grinding up to 40" x 192".

CORROSION RESISTANCE

The corrosion resistance of Ultrachem makes it highly resistant to rusting from water and humidity. Cooling channels will remain clean indefinitely for maximum cooling efficiency. It can be safely stored without surface deterioration. It better resists corrosion from the more highly corrosive plastics than AISI 420 stainless steels.

STOCK

Sizes up to 8" thick are available from warehouse stock, saw cut to customer's width and length. Sizes above 8" can be produced to customer's exact requirements as individual forgings from billet stock.

ULTRACHEM GRADES COMPARISON CHART

EDRO ULTRACHEM®

Application Edro Grade	Non-Critical Surface Ultrachem					High Quality Surfaces Ultrachem-ESR					Critical/Reflective Surfaces Ultrachem-ESR XTRA				
	Type	A	B	C	D	Type	A	B	C	D	Type	A	B	C	D
Cleanliness - ASTM E45	Thin	2.0	1.5	1.0	1.5	Thin	0.5	1.0	1.0	1.0	Thin	0.5	0.5	0.5	0.5
	Heavy	1.0	1.0	0.5	1.0	Heavy	0	0.5	0.5	0.5	Heavy	0	0	0	0
Hardness	38 - 42 HRC					38 - 42 HRC					38 - 42 HRC				
Microstructure	Tempered Martensite					Tempered Martensite					Tempered Martensite				
Grain Size - ASTM E112	5 or Finer					5 or Finer					6 or Finer				
Hot Work Ratio	3:1 minimum					3:1 minimum					4:1 minimum				
Certification	On Request					On Request					On Request				
Ultrasonic Rejection Criteria	8/64" Diameter FBH					5/64" Diameter FBH					3/64" Diameter FBH				

Chemical Analysis of Ultrachem Series

Element	C	Mn	P	³² S	Si	Cr	Ni	Cu	Nb + Ta
Aim	.05	.70	LAP	.08	.30	14.75	4.50	3.50	.30
Min.	.04	.55	-	.06	.20	14.25	4.25	3.30	.25
Max.	.06	.85	.030	.10	.40	15.25	4.75	3.70	.45

³²Sulfur for Ultrachem ESR will be .015 max. Sulfur for Ultrachem ESR XTRA will be .003 max.