

# Ferro-Tic Grade CM

## GRADE DESCRIPTION

Ferro-Tic Grade CM is an advanced metal matrix composite comprised of ultra-hard titanium carbide grains homogeneously dispersed in a high carbon-high chromium tool steel matrix. In the annealed state, it can be readily machined into any desired shape using conventional tooling. Grade CM exhibits excellent wear resistance and will retain its hardness under prolonged use at temperatures up to 975°F.

## APPLICATIONS

Ferro-Tic Grade CM is used for warm forming applications or wherever metal working or heavy friction could otherwise cause over-tempering or softening. Grade CM has been successfully used for screws, barrel liners and extrusion molding components in the plastics industry. It is also an excellent material for drawing and forming applications.

## CHEMICAL COMPOSITION GUIDE (weight %)

Carbide Phase	Binder Phase			
	Cr	Mo	C	Fe
Titanium Carbide	Cr	Mo	C	Fe
34.0	10.0	3.0	0.85	Bal

## PROPERTIES

Density, g/cc.....	6.45
Hardness, Rc	
Annealed.....	46-52
Hardened and Tempered .....	66-71
Transverse Rupture Strength.....	185
<b>(psi x 103)</b>	
Compressive Strength.....	482
<b>(psi x 103)</b>	
Impact Strength.....	211
(charpy unnotched) (in-lbs/in <sup>2</sup> )	
Tensile Strength.....	201
<b>(psi x 103)</b>	
Modulus of Elasticity, Mpsi .....	42
Coefficient of Thermal Expansion x 10 <sup>-6</sup> in/in/°F	
70°F-200°F.....	4.70
70°F-975°F.....	5.71
Linear Size Change	
Thru Heat Treatment, %.....	-0.0116



## ANNEALING

Use a slightly carburizing atmosphere or stainless steel envelope for protection. Heat to 1650°F, hold for 3 hours

Cool to 1450°F, hold for 8 hours

Furnace cool to below 1200°F,

air cool Hardness 46 – 52 HRC

(material is supplied in the annealed condition)

## HARDENING

### Austenitizing Temperature:

1975°F Holding Time: 1 Hour per inch of thickness (minimum 30 minutes)

### Austenitizing Method:

#### Protective Foil Envelope

Type 321 Stainless Steel Foil

.003 minimum thickness

Edges double crimped to prevent leakage

#### Air Quench:

Parts in protective envelope - start air flow (fan) over a heat sink plate remove pieces from envelope immediately after removing envelope from furnace, place pieces on heat sink

#### Vacuum Furnace

vacuum of 10 to 50 microns

Vacuum Quench: Positive pressure

quench (2 bar minimum) to below 125°F

#### Cold Treatment or Stabilization:

Must be done as soon as the quenched part reaches room temperature. Cool to -94°F or lower and hold for 1 hour per inch of cross section. Remove from cold treating unit and warm to room temperature. Temper immediately.

#### Tempering:

Should be done as soon as quenched parts reaches room temperature following the cold treatment. A double temper is required. Temper at 975°F, hold for 1 hour cool to room temperature Temper at 950°F, hold for 1 hour cool to room temperature Hardness 66 - 71 HRC