ASP®2011

Powder metallurgy HSS

CHEMICAL COMPOSITION

C	Cr	Mo	W	Co	V
2.45	5.3	1.3	-	-	9.5

SAFETY DATA SHEET SDS: A

STANDARDS

- USA: AISI A11

DELIVERY HARDNESS

- Typical soft annealed hardness is 280 HB.
- Cold drawn and cold rolled material is typically 10-40 HB harder.

DESCRIPTION

ASP®2011 is a high vanadium grade for wear applications.

APPLICATIONS

- Knives
- Wear parts
- Cold work

FORM SUPPLIED

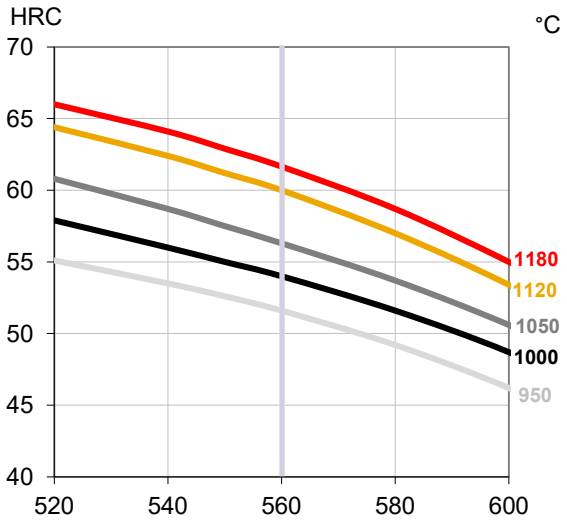
- Coils
- Coarse Round bars
- Flat and square bars
- Sheets
- Discs
- Pieces cut from sheets

Available surface conditions: peeled, rough machined, cold rolled, hot rolled.

HEAT TREATMENT

- Soft annealing in a protective atmosphere at 850-900°C for 3 hours, followed by slow cooling at 10°C/h down to 700°C, then air cooling.
- Stress-relieving at 600-700°C for approximately 2 hours, slow cooling down to 500°C.
- Hardening in a protective atmosphere with pre-heating in 2 steps at 450-500°C and 850-900°C and austenitising at a temperature suitable for chosen working hardness. Cooling down to 40-50°C.
- Tempering at 560°C three times for at least 1 hour each time. Cooling to room temperature (25°C) between temperings.

GUIDELINES FOR HARDENING



Tempering Temperature in °C
Hardness after hardening, quenching and tempering 3x1 hour

PROCESSING

ASP®2011 can be worked as follows:

- machining (grinding, turning, milling)
- polishing
- hot forming
- electrical discharge machining
- welding (special procedure including preheating and filler materials of base material composition).

GRINDING

During grinding, local heating of the surface, which may alter the temper, must be avoided. Grinding wheel manufacturers can provide advice on the choice of grinding wheels.

SURFACE TREATMENT

The steel grade is a perfect substrate material for PVD coating. If nitriding is requested, a small diffusion zone is recommended but avoid compound and oxidized layers.

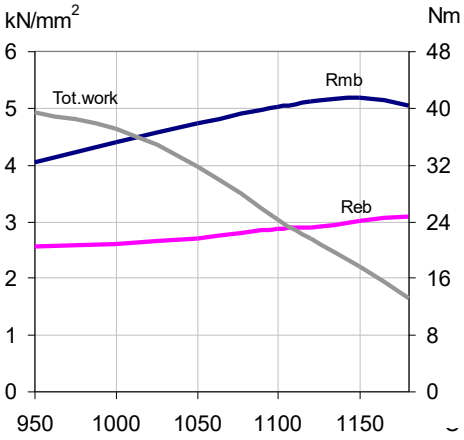
PROPERTIES

PHYSICAL PROPERTIES

Temperature	20°C	400°C	600°C
Density g /cm³ *(1)*	7.4	7.3	7.3
Modulus of elasticity kN/mm² *(2)*	220	197	177
Thermal expansion ratio per °C *(2)*	-	$11.8x10^{-6}$	$12.3x10^{-6}$
Thermal conductivity W/m°C *(2)*	20	25	26
Specific heat J/kg °C *(2)*	420	510	600

(1)=Soft annealed
(2)=Hardened 1180°C and tempered 560°C, 3x1 hour

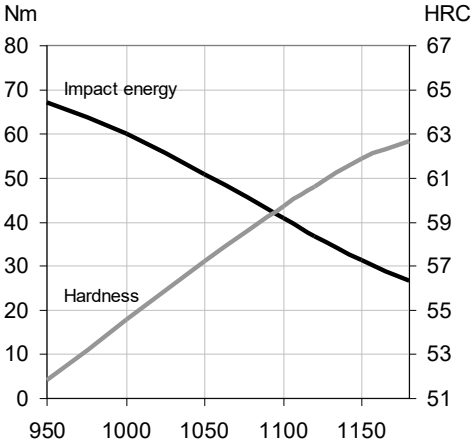
4-POINT BEND STRENGTH



Hardening Temperature in °C
Original dimension Ø 7.5 mm
Tempering 3 x 1 hour at 560°C
Dimension of test piece Ø 4.7 mm

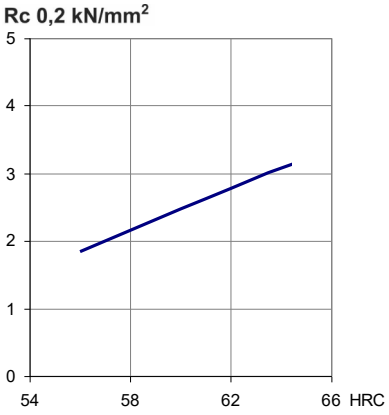
NB: High quality surface
Rmb = Ultimate bend strength in kN/mm²
Reb = Bend yield strength in kN/mm²
Tot. work = Total work in Nm

IMPACT TOUGHNESS



Hardening temperature in °C
Original dimension 9 x 12 mm
Tempering 3 x 1 hour at 560° C
Unnotched test piece 7 x 10 x 55 mm

COMPRESSION YIELD STRESS



COMPARATIVE PROPERTIES