

**ASP® 2009 is a high alloyed Powder Metallurgy grade for applications where high wear resistance and toughness are needed.**

## STANDARDS

> Not standardized

## DELIVERY HARDNESS

> Typical soft annealed hardness is 250 HB

## CHEMICAL COMPOSITION

Safety datasheet available

C	Cr	Mo	W	Co	V
1.90	5.3	1.3	-	-	9.1

## APPLICATIONS

- > Extrusion tooling
- > Hot work tools
- > Knives
- > Cold work

## FORM SUPPLIED

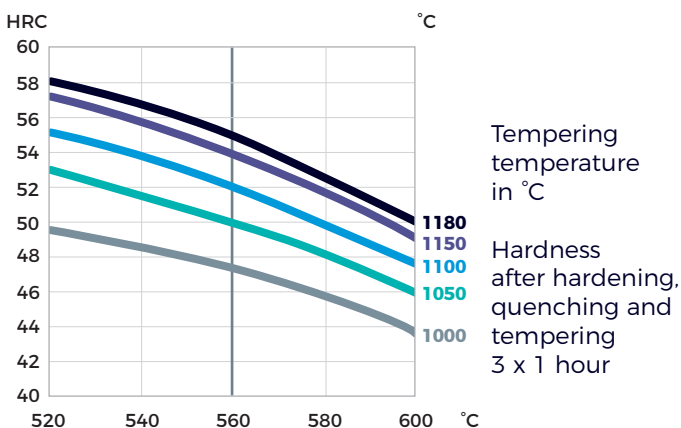
- > Round bars
- > Flat & square bars
- > Coils
- > Forged blanks

Available surface conditions: drawn, ground, hot-worked, rough-machined, 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 austenitizing 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



## PROCESSING

ASP® 2009 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**

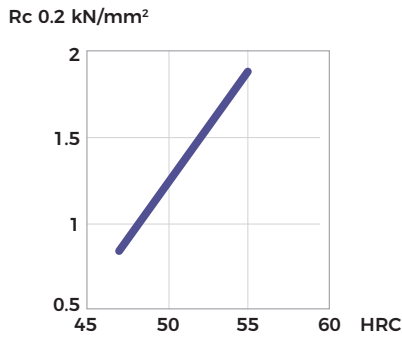
**PHYSICAL PROPERTIES**

Temperature	20 °C	400 °C	600 °C
Density g/cm <sup>3</sup> (1)	7.5	7.4	7.3
Modulus of elasticity kN/mm <sup>2</sup> (2)	221	197	177
Thermal expansion ratio per °C (2)	11.1x10 <sup>-6</sup>	11.6x10 <sup>-6</sup>	11.9x10 <sup>-6</sup>
Thermal conductivity W/m°C (2)	24	28	27
Specific heat J/kg°C (2)	420	510	600

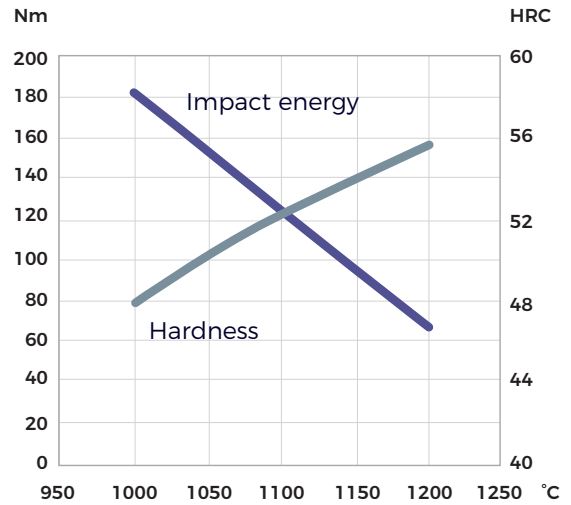
(1) Soft annealed

(2) Hardened 1180°C and tempered 560°C, 3 x 1 hour

**COMPRESSION YIELD STRESS**



**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

**COMPARATIVE PROPERTIES**

