

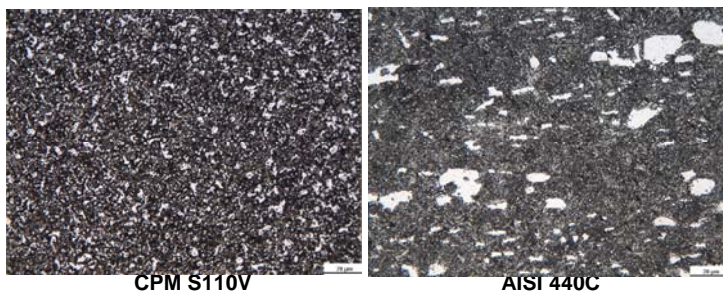
CRUCIBLE CPM[®] S110V[®]

Issue #1

CPM S110V is a high alloy martensitic stainless tool steel produced by the Crucible Particle Metallurgy (CPM) process. CPM S110V contains a high volume fraction of both vanadium-rich and niobium-rich primary alloy carbides for exceptionally good wear resistance compared to other commercially available PM tool steels. It also offers better corrosion resistance than 440C or CPM S90V.

CPM S110V is currently only available on special request in the as-HIP condition or as a clad layer on components. It is not available in forged or rolled bar lengths.

The CPM process results in a fine and uniform carbide distribution in CPM S110V compared to conventionally produced high alloy tool steels which results in relatively good machining, grinding, and toughness characteristics despite the high alloy content.



Typical Applications

As-HIP solid or clad components requiring a combination of high wear resistance and good corrosion resistance, such as:

- Screw elements, barrels and barrel liners for compounding machines
- Industrial knives, slitters and circular cutters
- Rolls and wear components for food and chemical processing applications

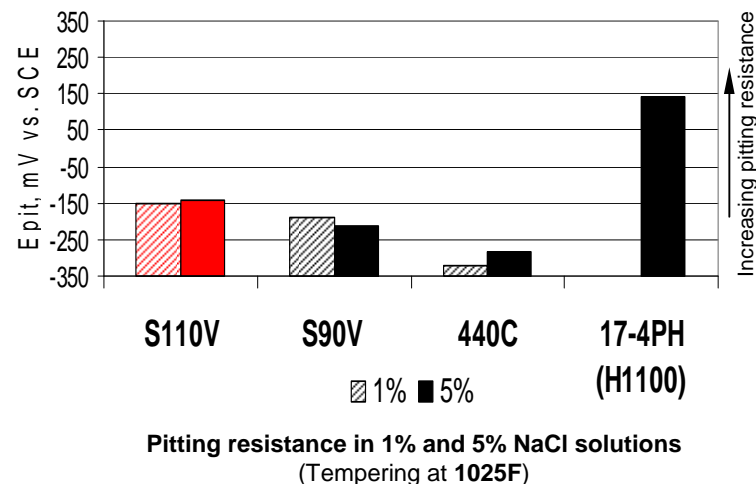
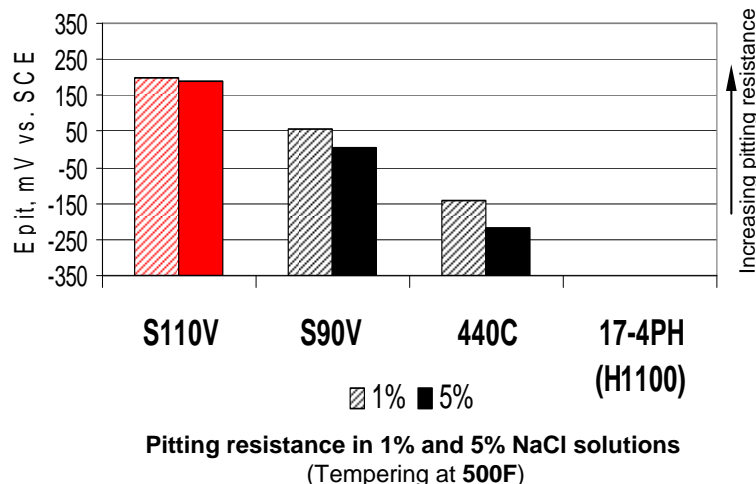
Machining and Grinding

Due to its carbide content and high annealed hardness, machining and grinding CPM S110V will be more difficult than 440C (or D2), and comparable to or slightly more difficult than CPM S90V. Grinding equipment and practices similar to those used for CPM S90V are acceptable. SG type alumina wheels or CBN wheels are recommended for best performance with CPM steels

Carbon	2.8%
Chromium	15.25%
Vanadium	9.0%
Niobium (Columbium)	3.0%
Molybdenum	2.25%
Cobalt	2.50%

Corrosion Resistance

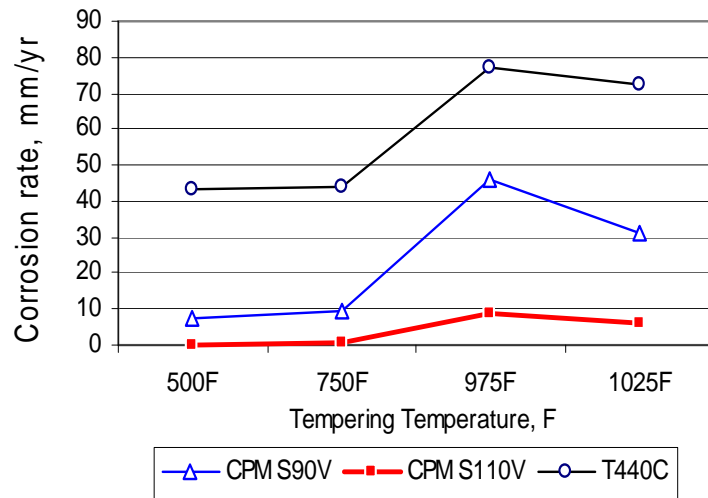
CPM S110V displays enhanced corrosion resistance compared to other high hardness martensitic stainless tool steels such as 440C and CPM S90V. Corrosion tests results in representative media are illustrated by the following laboratory test data.



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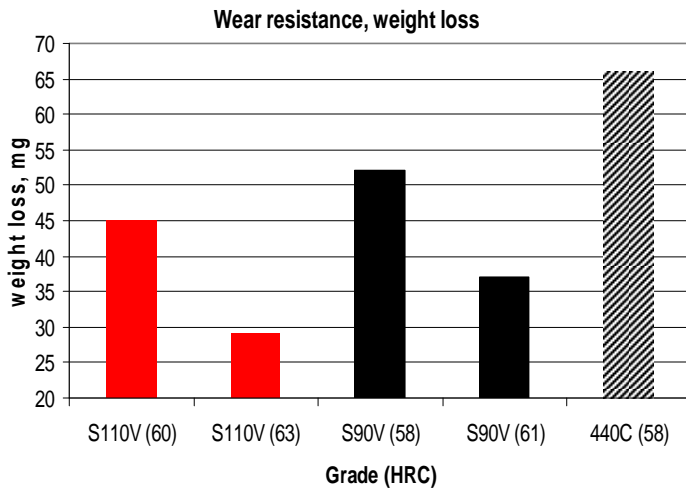
Thermal Treatments (cont'd.)



Corrosion Rate in Dilute Aqua Regia
(2.5% HNO₃ + 0.5% HCl + H₂O)

Wear Resistance

CPM S110V features the same high vanadium content as CPM S90V, plus the added contribution of 3.5% niobium, resulting in 25% greater volume of wear-resistant carbides, including 50% more of the wear-resistant MC type. The abrasive wear resistance of CPM S110V at various hardnesses is compared to other wear- and corrosion-resistant grades below.



Thermal Treatments

Annealing

Heat to 1650°F (900°C), hold 2 hours, slow cool at a maximum rate of 25°F (15°C) per hour to 1100°F (595°C), then furnace cool or cool in still air to room temperature

Annealed Hardness: Approximately 350-400 BHN

Stress Relieving

Annealed Material: Heat to 1100-1300°F (595-705°C), hold 2 hours, then furnace cool or cool in still air.

Hardened Material: Heat to 25-50°F (15-30°C) below original tempering temperature, hold 2 hours, then furnace cool or cool in still air.

Hardening

Austenitize: 2150°F (1175°C) Hold 20 minutes

Quench: Salt quench, interrupted oil quench, positive pressure gas quench or air cool at a minimum cooling rate of 250°F/min (140°C/min) to below 1000°F (540°C). Cool to below 125°F (50°C) before tempering. For optimum vacuum heat treatment response, a minimum 4 bar gas quench is recommended.

Temper: Temper three times, minimum hold time 2 hours at temperature each temper. Cool completely to room temperature between tempers.

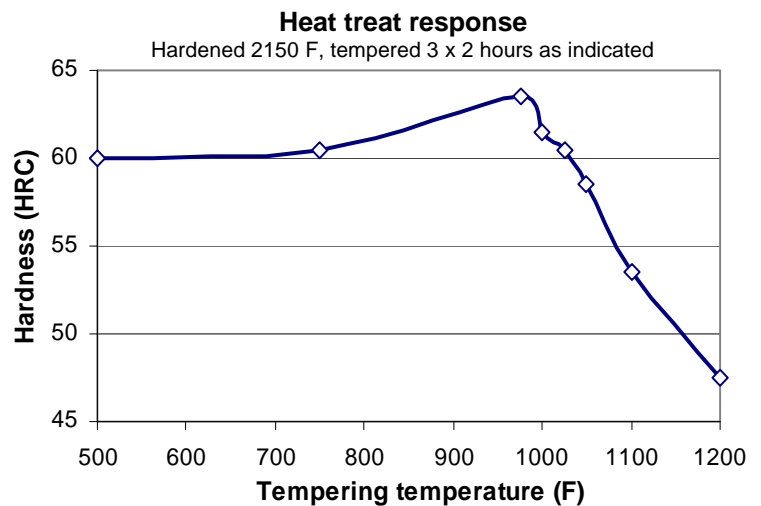
Tempering temperatures:

400-750°F (200-400°C): Best corrosion resistance

975-1000°F (525-540°C): Maximum hardness and compressive yield strength, reduced corrosion resistance

1025-1050°F (550-565°C): Optimum for best stress relieving and dimensional stability

Note: Tempering any martensitic stainless steel above 750°F (400°C) may reduce its corrosion resistance.

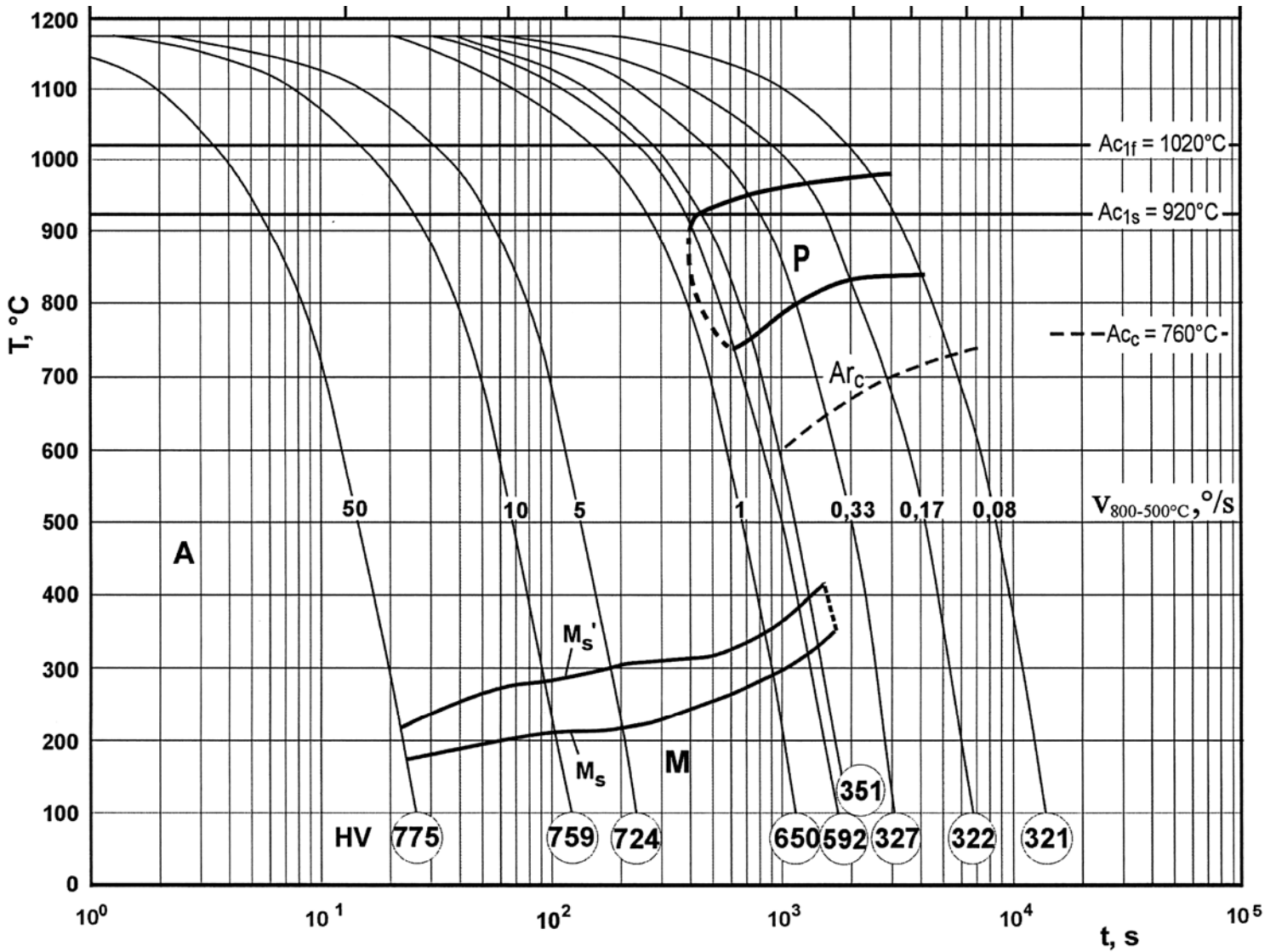


°F	500	750	975	1000	1025	1050	1100	1200
HRC	60	60.5	63.5	61.5	60.5	58.5	53.5	47.5

Deep freezing (optional): When tempering at or below 750°F (400°C), a freezing treatment may be used between the first and second tempers to reduce retained austenite and maximize hardness. Freezing treatments should always be followed by at least one temper.

Size Change: +0.03 to +0.05% for a fully martensitic microstructure. The presence of retained austenite may reduce the net growth.

Typical Application Hardness: 58/61 HRC



Continuous cooling diagram for CPM S110V, austenitized at 2150 F (1175 C)

Note: Properties shown throughout this data sheet are typical values. Normal variations in chemistry, size and heat treat conditions may cause deviations from these values.



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