

STELLITE® 6 ALLOY



COMPARISON OF THE PROPERTIES OF STELLITE 6® ALLOY WHEN SUPPLIED IN DIFFERENT PRODUCT FORMS

Stellite® 6 alloy is available from Deloro Stellite mainly in the following product forms:

- Castings (As-Cast; Cast & HIP'ed; Cast and Heat Treated) and weld hardfacings
- Wrought bar (Stellite® 6B – with a slightly lower carbon content)
- Wrought sheet/plate (Stellite® 6B, Stellite® 6K)
- Solid near-net shape or bar stock that has been HIP-consolidated from the powder form
- Welding and thermal spray consumables (rod, wire, powder)

Nominal Composition (mass %) and Physical Properties

Co	Cr	W	C	Others	Hardness	Density	Melting Range
Base	27 - 32	4 - 6	0.9-1.4	Ni, Fe, Si, Mn, Mo	37-45 HRC 400-490 HV	8.46 g/cm ⁻³ 0.305 lb/in ³	2340-2540 °F 1285-1395 °C

The cast and weld-deposited forms of Stellite® 6 have the typical hypo-eutectic structure consisting of complex wear resistant carbides dispersed in a tougher, more ductile CoCr alloy matrix, as shown below.

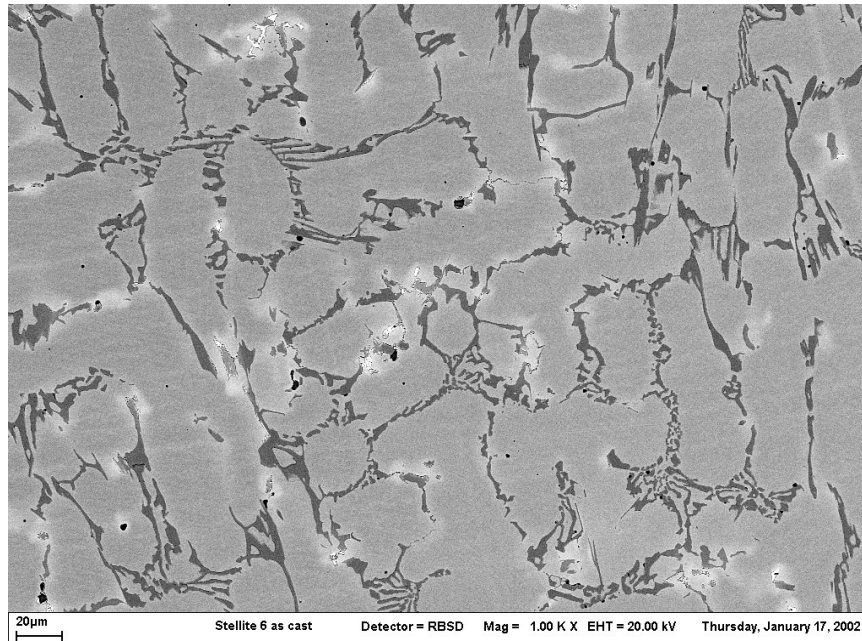


Figure 1: As-cast Structure of Stellite® 6 at 1000x magnification

This structure provides exceptional wear resistance, with the hard carbides providing sliding wear and abrasion resistance and the CoCr matrix providing resistance to galling, cavitation and corrosion. The main disadvantage of the cast structure is the appearance of these brittle carbides in the form of a semi-continuous network.

Castings are sometimes HIP'ed in order to close casting defects and pores, but this process does not have a significant effect on the morphology of the carbide network, although some aging and secondary carbide formation can occur.

The wrought (hot forged bar and sheet material) form of Stellite® 6B/ Stellite® 6B has an entirely different structure. The carbides have been broken up and dispersed evenly in the microstructure during the mechanical deformation experienced by the material during manufacture.

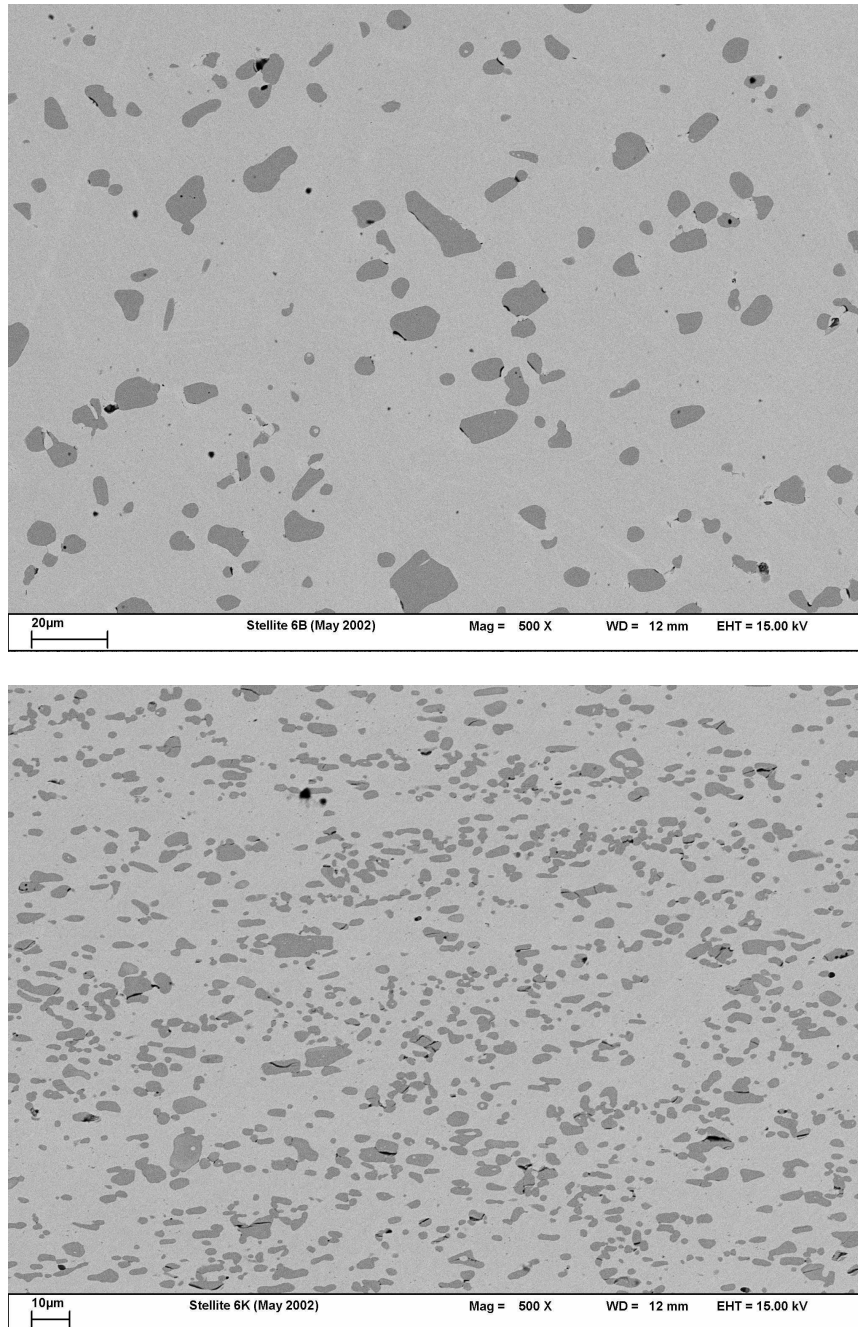


Figure 2: Wrought Structure of Stellite® 6B and 6Kat 500x magnification

This structure allows the carbides to continue to perform their function as the primary wear resistant component in the alloy, but inhibits their ability to act as a brittle crack-propagating network. Hence the wrought form exhibits dramatic improvements in mechanical properties and toughness. The toughness of the wrought alloy, depicted by its Charpy impact energy goes up almost four-fold compared to the cast version whilst wear resistance and hardness is unaffected. **In addition, typical casting defects such as centre-line porosity are absent.**

Typical Properties of Wrought vs Cast Stellite® 6

Property	Cast Stellite® 6	Wrought Stellite® 6B
Tensile Strength	790 - 840 MPa	900 MPa
Yield Strength	480 MPa (at 0.1% offset)	480 MPa (at 0.2% offset)
Tensile Elongation	< 1%	5%
Charpy Impact Energy (unnotched @ R.T.)	12 J	≈ 40 J

The aqueous corrosion resistance of wrought alloys is also superior to the cast version, due to the more uniform carbide structure. These dramatic improvements shown by **Stellite® 6B/6K** along with its machinability has made the material an excellent choice for critical wear components where heat or corrosion is involved.

The HIP-consolidated form of Stellite® 6 has a structure similar to that of the wrought forms, but with an even finer carbide dispersion. The carbides are dispersed evenly in the microstructure because they have precipitated out of the gas-atomised powder during the HIP process.

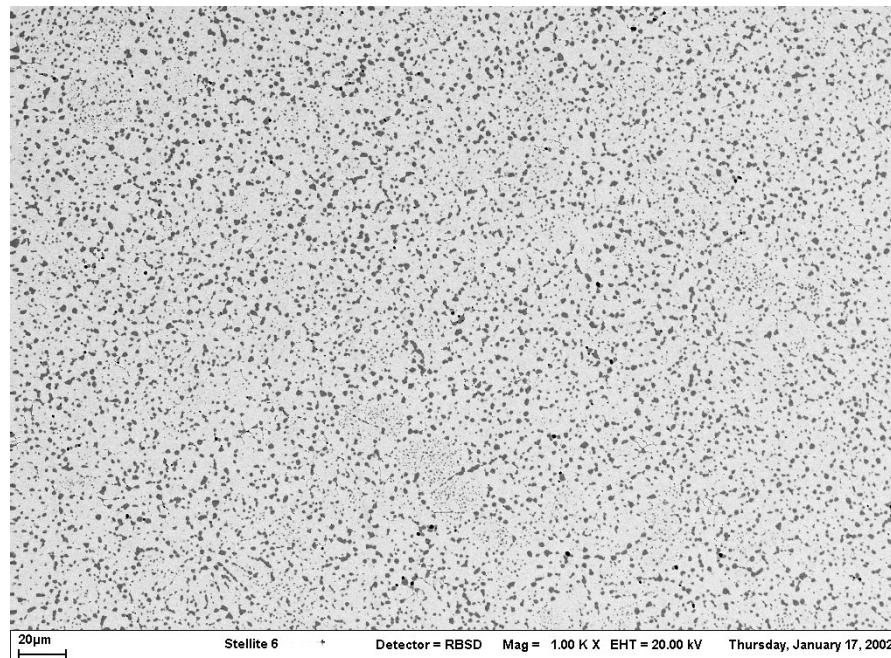


Figure 2: HIP (Hot Isostatic Press) consolidated Structure of Stellite® 6 at 1000x magnification

Compared to the wrought structure, the HIP'ed form exhibits even more dramatic improvements in the mechanical properties and toughness whilst wear resistance is unaffected (with the exception of severe low-angle abrasive-particle wear resistance which can be a little reduced in the HIP'ed alloys).

Typical Properties of HIP-consolidated vs Cast Stellite® 6

Property	Cast	HIP'-consolidated
Tensile Strength	790 - 840 MPa	> 1200 MPa
Yield Strength	480 MPa (at 0.1% offset)	> 730 MPa (at 0.2% offset)
Tensile Elongation	≤ 1%	10%
Charpy Impact Energy (unnotched @ R.T.)	12 J	100 J

CONTACT US:

Please refer to our web site <http://www.stellite.com> for contact information.

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