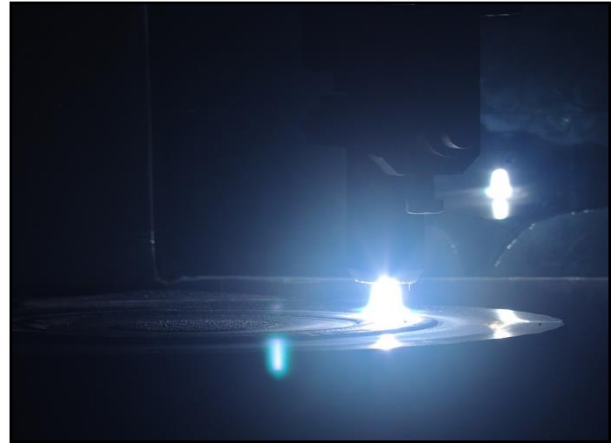
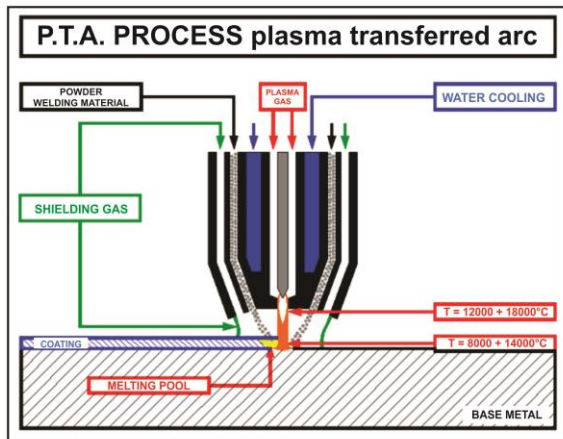


Plasma Transferred Arc (PTA) Weld Hardfacing  
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**Process Fundamentals**

Plasma Transferred Arc (PTA) weld hardfacing is a true welding process used to produce high-quality weld hardfacings of Ni, Co and Fe alloys, and tungsten carbide containing grades of the nickel alloys. The principle of PTA welding is illustrated in the figure below:

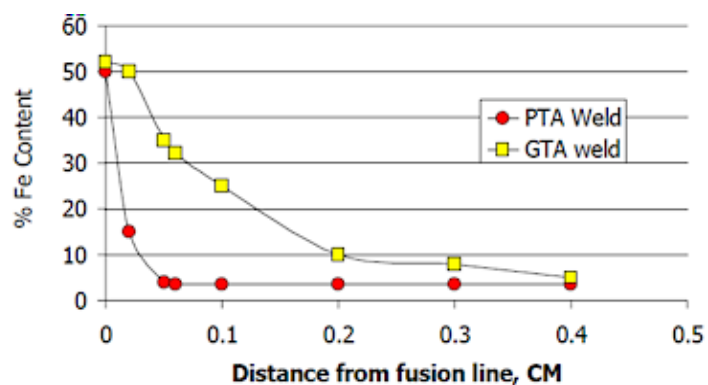


The PTA hardfacings are metallurgically bonded to the parent material, and are able to handle impact, point and/or line loads that a thermal spray coating cannot tolerate. The advantages of PTA welding over other weld hardfacing technologies is that PTA weld deposits are characterised by low levels of inclusions, oxides and discontinuities, and the weld hardfacing closely mimics the corrosion resistance of the equivalent monolithic alloy. Most critically, the careful control of heat input makes it possible to control weld dilution to less than 5%, which is critical for many high-performance alloys.

**Hardfacing Materials**

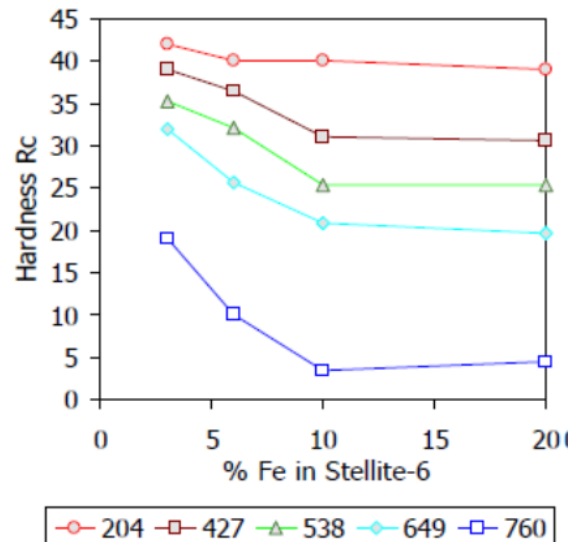
PTA is generally used to apply high-alloy nickel and cobalt based alloys. The best known group of hardfacing materials are the Stellite® alloys, of which Stellite® 6 is the most common. These materials combine excellent corrosion- and wear-resistance, and are especially known for their anti-galling or metal-to-metal wear resistance. These advanced alloys tend to maintain their properties to very high temperatures, but require careful treatment during application as a hardfacing to ensure that they maintain these desirable properties.

As an example of the damage that can be done to these sophisticated alloys, the Figure on the right compares the amount of iron in dilution in a weld hardfacing Stellite® layer applied by PTA and GTA (better known as TIG) welding. It is clear that the high-energy electric arc from the TIG welding processes results in the dilution of a large amount of iron in the Stellite® alloy layer.



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Once the iron content of a Stellite® alloy increases above approximately 5%, it has a profound influence on the hot-hardness of the Stellite® alloy. As illustrated in the Figure to the right, an arc-welded Stellite® 6 hardfacing containing ~10% iron will have approximately 30% lower hardness when compared to a PTA welded Stellite® 6 hardfacing at 538°C – a typical operating temperature for a steam valve component. This will mean that the wear and especially galling resistance of these two nominally equivalent hardfacings will be profoundly different at temperature. This problem will not be identified if a comparison is made of the room temperature hardness, as this only indicates a 5% hardness difference.


**Typical Applications**

Generally PTA hardfacings are used when there is a combination of severe corrosion, high mechanical loads and/or high temperature wear.

Typical applications include:

- High temperature steam turbine valve components
- Severe service ball valves
- Marine hydraulic cylinders
- Chipper disks segments in wood pulping and chipping
- Hot mill side-guides

**PTA technology provides a range of benefits compared with conventional welding processes:**

- Micro-plasma welding
- Extremely low dilution
- Outstanding repeatability
- Minimal post-weld finishing
- High energy density
- Minimal heat affected zone
- Short welding times

Please contact Thermaspray to discuss your specific requirements and the proven solutions we can offer you.

**References:**

- Lab Report 470 Stellite® Weld Dilution extract
- Stellite® is a registered trademark of Kennametal Stellite.