

Unprecedented Galling Resistance of 316L after Expanite Surface Hardening.

Galling, or adhesive wear, is a pervasive problem for stainless steels, of which the soft 300 series are notoriously prone. In an on-going effort to increase its database of engineering data, Expanite recently conducted the ASTM G98 Standard Test Method for Galling Resistance of Materials on AISI 316L, with and without Expanite surface treatment. The results were remarkable, and challenge the conventional wisdom that a 'hardness differential' in a material couple is required to resist galling.

The test geometry involves a cylindrical button which is rotated 360° against a stationary block under increasing normal force. After rotation, the contact surfaces are visually inspected for galling, defined in the standard as "a severe form of wear characterized by localized, macroscopic material transfer, removal or formation of surface protrusions when two solid surfaces experience relative sliding under load". The load is gradually increased until galling is observed, thereby establishing the *threshold galling stress*. The table below lists the extent of galling observed with increasing load.

Load	Galling observed	
	Non-treated samples	Expanite-treated samples
3.4 MPa (0.5 ksi)	Minor	None
7 MPa (1 ksi)	Major	None
14 MPa (2 ksi)	Major	None
34 MPa (5 ksi)	Major	None
276 MPa (40 ksi)	Major	None

The photos to the right demonstrate the remarkable galling resistance afforded by Expanite surface hardening. At the bottom, two non-treated 316L surfaces gall under very low normal stresses of 3.4–6.9 MPa (0.5–1.0 ksi). In a mating couple with two SuperExpanite-treated surfaces of 316L shown at the top, galling is completely mitigated beyond the yield strength of the material! Steven Budinzski, owner of Bud Labs (Rochester, NY), where the test was conducted remarked, "I've never seen such a solution to galling of 316L in my many years of tribology testing". Expanite surface hardening of one contact surface in a material couple does not lead to galling, but rather 'burnishing' of the non-treated surface.



Surface Hardening

The patented process that produced such results is known as Expanite. With Expanite, it's possible to increase the surface hardness of stainless steels by up to 10 times, while maintaining or even enhancing corrosion resistance. This method is considered unique since it's suitable for austenitic-, ferritic-, martensitic and duplex stainless steels. Parts can be treated with extremely short lead times—a few days—which is previously unseen within surface hardening of stainless steel.



The Expanite technology can significantly increase the value of products across many industries—from knives, valves, mixers, and grinders for the food industry, to pumps and extruder screws, or injection parts for the automotive sector, as well as screws, bolts, and washers.

At its core, Expanite offers 3 different processes, each of which can be optimized according to customers' requirements in terms of abrasion, galling, corrosion and scratch resistance. This means that Expanite can develop and customize solutions for a wide variety of companies and industries.

Expanite

Expanite was founded in 2010 by three scientists from The Technical University of Denmark. Expanite is based in Hilleröd, Denmark, has a treatment facility located in Twinsburg, Ohio and this summer Expanite will open a treatment center in Frickenhausen, Germany. For further information, please contact Thomas Abel Sandholdt, CEO at Expanite, +45 2040 7207, or check our website: www.expanite.com.