

Outstanding galling prevention by using Expanite hardening on martensitic stainless steels!

Galling or adhesive wear

Galling is a pervasive problem for stainless steel – even on martensitic stainless steel treated with a standard vacuum hardening – the challenges still exist. Based on a standard ASTM test G98 for galling resistance of materials, the galling prevention results on the martensitic stainless steel with the ExpaniteHigh-T surface hardening process are remarkable and show that Expanite offers superior solutions to improve galling resistance!

ASTM standard test for galling resistance

The ASTM G98 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.

Test results, standard vacuum hardening against ExpaniteHigh-T

The test result shows a remarkable galling resistance afforded by ExpaniteHigh-T surface hardening. Two standard heat treated 1.4021 surfaces gall under very low normal stresses of 0.7 MPa (0.1 ksi). In a mating couple with two ExpaniteHigh-T-treated surfaces of martensitic stainless steel 1.4021 shown in fig 3 and 5, galling is completely mitigated until very high loads are applied (between 689bar and 1034bar). Notice that when comparing with and without ExpaniteHigh-T, a 150-fold increase of contact pressure is required to induce galling.

Results with Expanite - a case study

A valve manufacturing company aimed to replace conventional heat treatment for higher performance in their valve seat for gasoline high-pressure pump. The Expanite® process increased corrosion and wear resistance and even simplified logistics since the Expanite hardening process was now made available in Europe, Asia and the US.

Load	Galling observed	
	Standard vacuum hardened	ExpaniteHigh-T treated
7 bar (0.67MPa/0.1ksi)	Major galling	Not relevant/ no galling
35 bar (3.4MPa/0.5ksi)	Major galling	Not relevant/ no galling
69 bar (6.9MPa/1ksi)	Major galling	No galling
345 bar (34MPa/5ksi)	Major galling	No galling
1034-2068 bar (96.5-207MPa/ 15 -30ksi)	Not relevant/ destructive	Major

Fig 1: Summary of test results

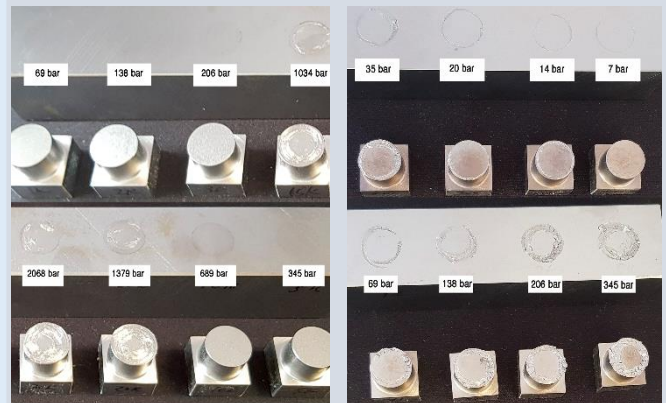


Fig 2: With Expanite

Fig 3: Without Expanite



Fig 4: With Expanite



Fig 5: Without Expanite