Want a Superior Wear Surface?

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MicroSurfacing cost-effectively produces superior wear surfaces for gears and other load-bearing metal components.

How can design engineers improve the wear performance of gears, bearings and other critical metal components? Through a procedure that is not easy - improving the topology of the component's surface profile.

Engineers must first fully understand the topology parameters of the wear surface and how they affect the tribological (friction) performance of the wear surface. Next, they must evaluate ways to achieve desired topology. Enter MicroSurfacing technology.

More Than Just a Smooth Surface

Many design engineers still believe low surface roughness (Ra) is the primary surface parameter controlling friction (heat production) on wear surfaces. Even though Ra is important, it must be accompanied by other surface parameters in the correct state to produce the desired tribological performance. Ra does not tell the whole story about a surface. For example, Figure 1 illustrates profiles of three surfaces with the same Ra.

Though their Ra is the same, each surface has a different finish and wears differently. Design engineers must understand which profiles yield the best surface finish for wear performance and load bearing properties. The following profile parameters and value ranges indicate whether a particular wear surface has good load bearing properties for precision components:

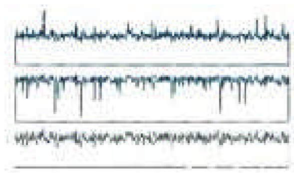

Figure 1. Three surface profiles having the same Ra.

1. Ra - Roughness average: 1.5 to 5.0 micro-in (0.038 to 0.13 microns).
2. Rsk - Skewness: negative skew of - 0.25 to - 3.0. (see Figure 2 below)
3. Rt - Maximum height of the profile: less than 20 micro-in (0.5 micron)
4. Rz - Average maximum height of the profile: maintained close to Rt results
5. Rpk - Reduced peak height: 1.0 to 3.0 micro-in (0.025 to 0.08 micron)
6. Rvk - Reduced valley depth: 2.0 to 12.0 micro-in (0.05 to 0.3 micron)

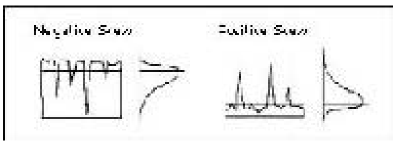

Figure 2. A comparison of negative and positive skewness profile parameters.

A precision wear surface performs best when its ratio of Rvk to Rpk is at least 2 to 1. Maintaining surface parameters in these ranges removes micro asperities (peaks) while valley depths are maintained for lubrication retention. MicroSurfacing produces surface ratios having a negative skew (Rsk, Sk) and the optimum ratio of Rvk to Rpk.

Achieving Run-In Without the Wait

Many parameters affect a wear component's fatigue life, including the surface profile parameters, composition, hardness/micro-structure, coatings, geometric design and the lubricant being used. Assuming all other parameters remain constant, surface profile parameters have the most dramatic effect on wear fatigue life. The final surface finish is a major factor in determining surface life.
Precision components function best after surface asperities are worn, the point of optimal surface topology. This time period is called the "run-in" period. Many current traditional superfinished wear components require an initial run-in period.

Components manufactured with MircoSurfacing technology.

Manufacturers unable to wait through this period may apply manganese phosphate, a sacrificial coating employed to reach the desired run-in surface topology. These sacrificial coating processes are expensive and lengthen manufacturing process times.

MicroSurfacing produces wear surfaces with a topology equal to or superior to that of components that have been manganese-phosphate coated, or "run-in."

Lose the Abrasives

Many abrasives like aluminum oxide, silicon carbide, quartz and graphite are used in a variety of surface finishing practices, such as grinding, polishing, tumbling/vibratory finishing, honing and lapping. Abrasives cut away burrs, remove scales/oxides, and remove surface material for dimensional sizing to form and produce the desired shape and surface roughness.

The downside to these surface finishing practices is that abrasives become impregnated into the component surface. These "surface contaminants" affect the component's wear performance and fatigue life. In critical wear surface applications, the contaminants must be removed by chemical or electro-chemical means. In non-critical wear surface applications, the contaminants aren't usually removed because they do not interfere enough with the intended performance of the wear component. However, while the component meets its present day performance specification, it would likely perform better without the impregnated contaminates.

Produce A Better Surface

Figures 3, 4 and 5 illustrate the superior surface of a metal component that was finished using MicroSurfacing technology as demonstrated by Falex V-Block and Pin Friction tests. Reducing abrasive and other particulate content results in a surface finish that boasts reduced Coefficient of Friction (COF) and surface wear, and uses lower torque to drive the same load.

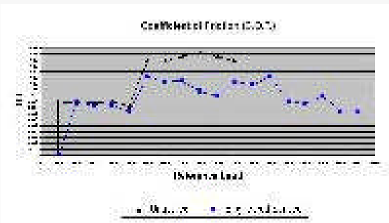

Figure 3

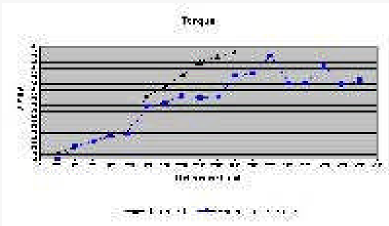

Figure 4

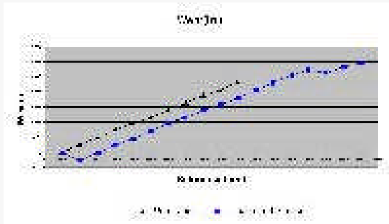

Figure 5

Possible Applications

MicroSurfacing was initially introduced to the gear and bearing industries. The technology is now used in a wide variety of industrial components, including conveyor chains, precision washers, forge dies, cast iron piston sleeves, camshafts, crankshafts, engine valves and hydraulic pumps, hydraulic/pneumatic shafts, injection mold dies and springs. MicroSurfacing is an alternative for honing, lapping, grinding, shotblasting, tumble/vibratory finishing and some machining. MicroSurfacing reduces the use of abrasives in surface finishing and produces surfaces of extremely low surface roughness. This low surface roughness, with the correct load bearing properties and virtually no micro-asperities to cause frictional drag between two opposing surfaces, can be utilized in a vast array of surface finishing operations.

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Benefits of MicroSurfacing

- Extremely low micro-finish
- Increased component fatigue life
- Reduced operating temperature
- Reduced torque requirement
- "Run-in" surface with no wait
- Faster refined surfaces
- Repetitive grinding steps eliminated
- Shot blasting eliminated
- Reduced harmonic vibrations (noise)