ROYSON ENGINEERING COMPANY

HOUGHTON MicroSurface™ Technology: A better way to produce a superior wear surface for gears and other load-bearing metal components

How can design engineers improve the wear performance of gears, bearings and other critical metal components? Simply put, they must find ways to improve the topology of the component's surface profile. But the procedure of accomplishing this is far from simple. Engineers must fully understand the topology parameters of the wear surface and how this topology affects the tribological (friction) performance of the wear surface. They must then evaluate ways to achieve the desired topology. That's where MicroSurfacing technology can help.

A MicroSurface is More Than Just a Smooth Surface

There are still many design engineers that believe that low surface roughness (Ra) is the primary surface parameter that controls 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.

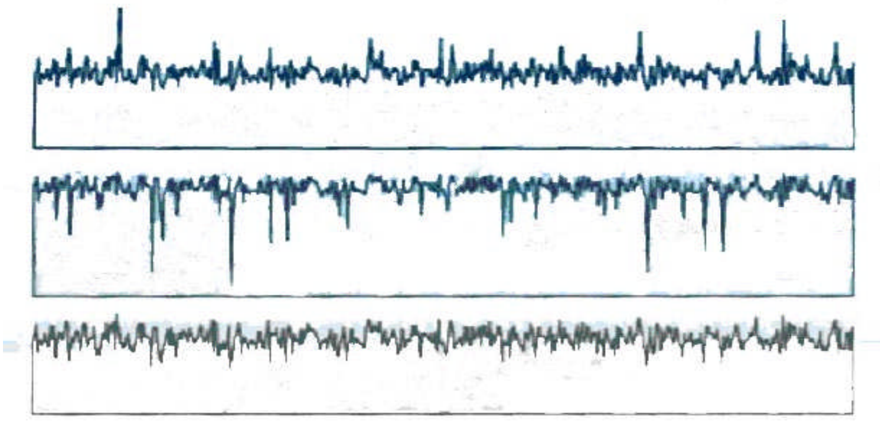

Figure 1

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

1) **Ra - Roughness Average**: 1.5 to 5.0 Micro inch (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 inch (0.5 Micron)

4) **Rz - Average Maximum Height of the Profile**: Maintained close to Rt results.

5) **Rpk - Reduced Peak Heig**ht: 1.0 to 3.0 Micro inch (0.025 to 0.08 Micron)

6) **Rvk - Reduced Valley Depth**: 2.0 to 12.0 Micro inch (0.05 to 0.3 Micron)

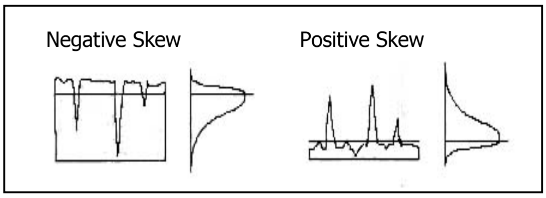

Figure 2

A precision wear surface performs best when its ratio of Rvk to Rpk is at least 2 to 1. When parameters are maintained in these ranges, the resulting wear surface has micro asperities (peaks) removed, while maintaining valley depths for lubricant retention. MicroSurfacing technology produces surface topology that have a negative Skew (Rsk, Sk) as well as the optimum ratio of Rvk to Rpk.

Achieving Run-In without the Wait

A wear component's fatigue life is affected by many parameters. These include the surface profile parameters, as mentioned above, as well as composition, hardness/micro-structure, coatings, geometric design and the lubricant 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 that determines how long that wear surface will last.

Precision components function optimally after they have been used long enough for the asperities on the surface to be worn down, forming the optimal surface topology. This period of time is called the “Run-In” period. Many present day traditional superfinished wear components require an initial run-in period. If manufacturers can’t afford to wait through the run-in period, they can use a process like Manganese Phosphate coating, which applies a sacrificial coating to reach the desired run-in surface topology. However, these sacrificial coating processes are expensive and add time to the manufacturing process.

MicroSurfacing technology produces wear surfaces with a topology equal to or superior to that of components that have been “Run-In” or Manganese Phosphate coated. And the optimum surface is accomplished without the wait or additional cost of expensive sacrificial coating processes.

Lose the abrasives

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

The downside to these surface finishing practices is that the abrasives become impregnated into the component surface. These “surface contaminates” affect the component’s wear performance and fatigue life. In critical wear surface applications, the contaminates must be removed by chemical or electro-chemical means. In non-critical wear surface applications, the contaminants usually don’t need to be removed because they do not interfere enough with the intended performance of the wear component.

However, though the component meets its present day performance specification, it would likely perform better without the impregnated contaminates.

MicroSurfacing technology reduces the need to use abrasives in order to remove burrs, scales/oxide and refine wear surfaces. This gives an enormous advantage for manufacturers to produce wear surfaces that are metallurgically clean of impregnated abrasives. Microsurfacing technology was originally developed for mass finishing environments, such as tumbling/vibratory finishing. Since then MicroSurfacing has proven to be a cost-effective alternative to mechanical manufacturing operations like surface grinding, lapping, and shot blasting, because it does not require the use of abrasives.

MicroSurfacing technology simply produces 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. By reducing the abrasive and other particulate content when surface finishing, wear surfaces can be manufactured that have reduced Coefficient of Friction (C.O.F.), use lower Torque to drive the same load and reduce Surface Wear.

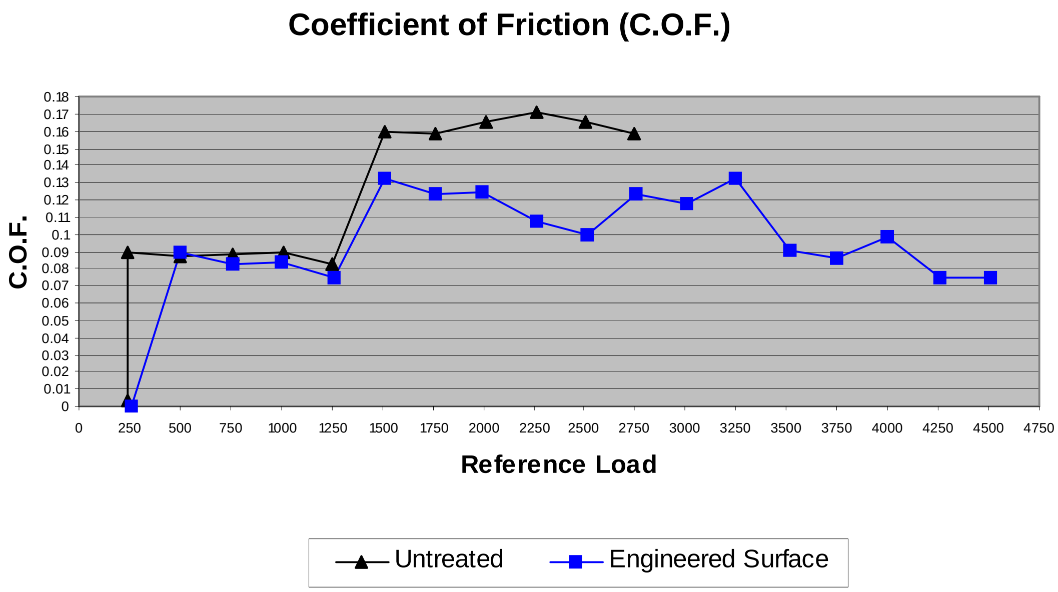

Figure 3

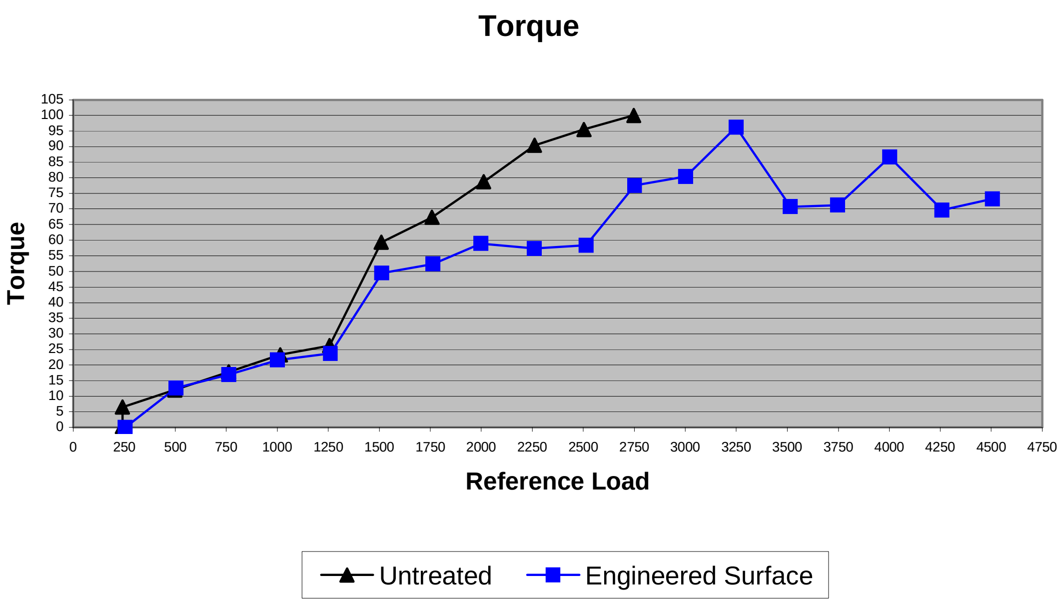

Figure 4

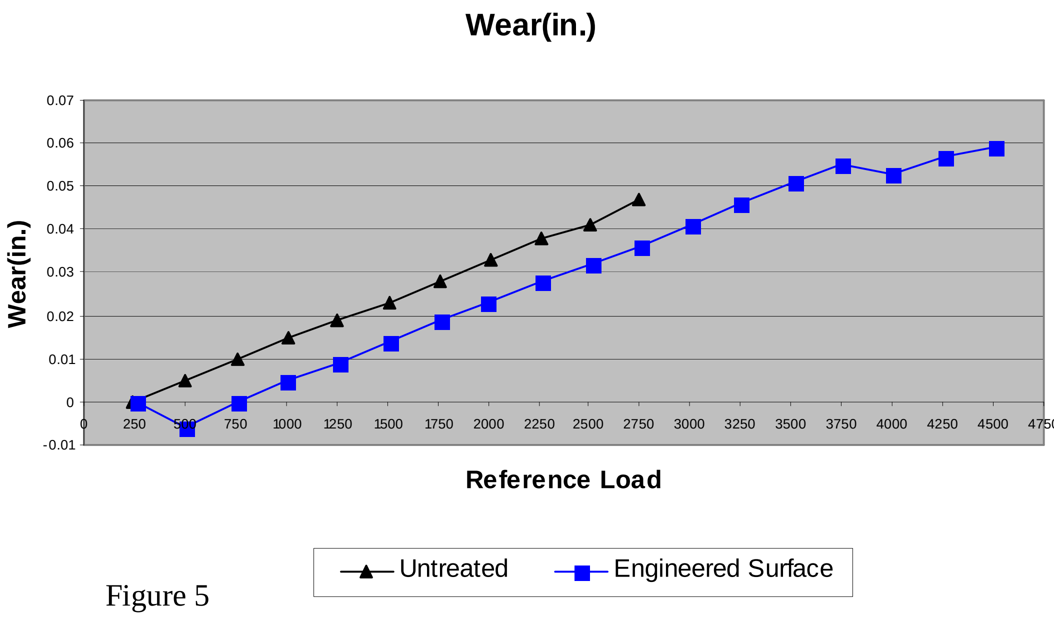

Figure 5

The Many Possible Applications for HOUGHTON MicroSurfacing Technology

MicroSurfacing technology was initially marketed to the gear and bearing industries, but has since found application in a wide variety of other 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. All of these metal components benefit from the increased surface wear inherent with the process. MicroSurfacing technology can also be used as an alternative process for honing, lapping, grinding, shotblasting, tumble/vibratory finishing and some machining.

In summary, MicroSurfacing technology reduces the use of abrasives in surface finishing and produces surfaces of extremely low surface roughness. This low surface roughness, having 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.

The Benefits of MicroSurfacing Technology:

- Produces extremely low micro-finish
- Increases component fatigue life
- Reduces operating temperature
- Reduces torque requirement
- Produces a ”Run-In” surface with no wait
- Refines surfaces faster
- Eliminates repetitive grinding steps
- Eliminates shot blasting
- Reduces harmonic vibrations (noise)