



Application Note to the Field

Silicon Carbide

Application Note Number: 1602-1

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Silicon carbide is a material that possesses several advantageous properties when used in a gear pump. First, it is important to note that silicon carbide (SiC) is a chemical compound and not just an amalgamation of the elements silicon and carbon. Therefore, its physical and chemical properties are quite different from that of its individual base elements (like table salt, NaCl, is much different from its base elements of sodium and chlorine).

The grade of SiC which Liquiflo uses is an alpha-sintered grade, meaning it is pure SiC with no extra binders or fillers. This provides a superior level of chemical resistance, even at elevated temperatures, where other materials may fall short.

In addition to the excellent chemical resistance of SiC, the wear properties are quite impressive too. SiC is extremely hard and durable. This property makes it useful as a bearing, shaft, wear plate and seal seat material. A gear pump test performed at Liquiflo had SiC shafts vs. SiC bearings running for 50,000 hours at 1150 RPM, lubricated by 100°F water (~ 0.7 cP) at 100 PSI differential pressure. After 50,000 hours (almost 6 years of running time), there was only negligible signs of wear.

Several years ago, Liquiflo changed its standard wear plate and seal seat material from ceramic aluminum oxide (Al₂O₃) to self-sintered SiC, due to the overall superior properties of the latter material. For sealed pumps, the standard and most common seal arrangement is a single internal mechanical seal with Carbon seal face vs. SiC seal seat. This material combination has good wear properties and can be applied for a wide range of fluids and conditions (i.e., differential pressures to 150 PSI or higher, temperatures to 500°F and viscosities to 5,000 cP).

Due to the extreme hardness of SiC, a coated shaft, preferably Tungsten Carbide (TC) coated, or a solid SiC shaft in the case of the Poly-Guard pump, must be used when utilizing SiC bearings. Also, it is not suggested to pair SiC wear plates with a metal drive gear (or double metal gears) for viscosities under 100 cP; otherwise, the wear plates can cause accelerated wear to the sides of the gear(s). If light abrasives are present in the fluid, SiC can help to increase pump life; however, the abrasives may have a negative effect on other pump components.

When silicon carbide is employed to provide extra wear resistance, a common configuration to use is two PEEK gears, SiC wear plates and bearings, and TC-coated shafts. An example H5F mag-drive pump model code would be: **H5FSPP4B002000US**.

The caveat to using SiC is its susceptibility to damage by mechanical and thermal shock. If the pump were to be dropped, there is a chance of the SiC components breaking or chipping. If the pump were to be run dry, excessive heat can build up between the bearing and the shaft extremely quickly, which can cause the material to crack. For this reason, a pump with SiC components should never be run dry.