NIC INDUSTRIES,INC.

Evaluation of the Coefficient of Fricton for **C-110 CERAKOTE™ MicroSlick** Dry-Film Lubricant

C-110 Cerakote™ MicroSlick is an ambient cure coating specifically designed to increase lubricity in areas of low tolerance. C-110 is commonly used on engine components, such as piston skirts, valve stems and timing chains, as well as wide range of objects including saw blades, bolt threads, gears, and ball-bearings. The properties of C-110 MicroSlick are summarized in table 1. MicroSlick is a durable coating that can be applied in a thin layer (0.10-0.50 mil) to a wide range of substrates. For this study, the coefficient of friction for C-110 against stainless steel was tested. A brief explanation of the testing theory, method, and procedure is detailed in the first section. Finally, the results of the study are discussed and related to the coefficient of friction of common materials. Testing to determine the coefficient of friction was performed by E.P. Laboratories, Inc, an independent laboratory.

Table 1. Physical properties of Cerakote™ C-110 MicroSlick

% Solids	Pencil Hardness	Scratch Hardness	Adhesion	Mandrel Bend	Impact
23% ± 2%	6h	hb	5b	1 mm loss at 180° rotation	80/60 inch-lbs

Theory and Procedure for Testing the Coefficient of Friction

The coefficient of friction (μ) is a unitless number which is used to indicate the mechanical and/or molecular interaction between surfaces that are moving against one another. Surfaces with a low coefficient of friction can move across one another more easily than surfaces with a higher coefficient of friction. Perfectly smooth frictionless surfaces have a coefficient of friction equal to zero. For this study, the coefficient of friction for Cerakote™ C-110 MicroSlick was evaluated using a linear reciprocating tribometer. A schematic detailing the arrangement of the tribometer is shown in figure 1. First, a test panel was placed on a stand, and then the tribometer lever arm was fitted with a stainless steel sphere and a 1 N load. Next, the sample panel is moved back and forth in a linear fashion. The value of μ is determined by measuring the deflections of the lever arm as the panel passes underneath.

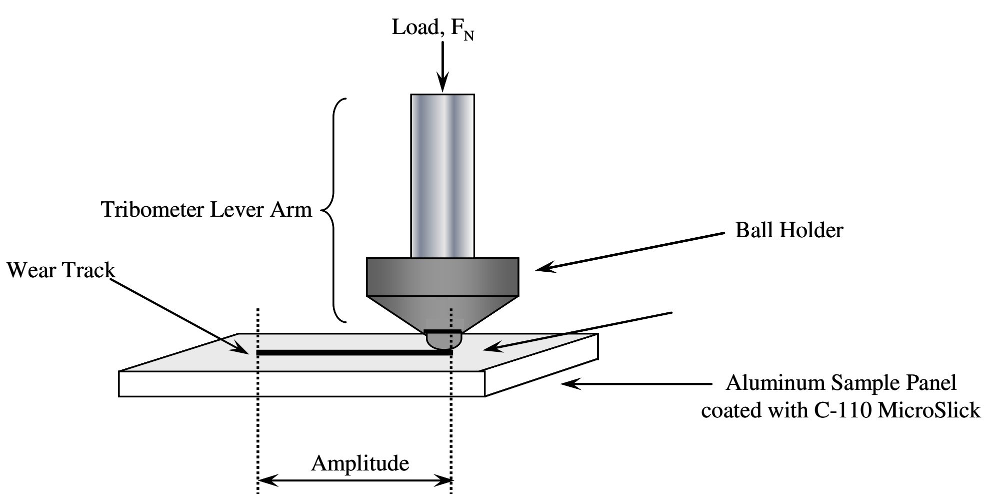

Figure 1. Schematic of a linear-reciprocating tribometer used to determine the coefficient of friction (μ) between Cerakote™ C-110 MicroSlick and stainless steel.

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Results

The results of the friction test are shown in figure 2 and study is outlined in table 2. Values for μ at the beginning and end of the test were recorded to clarify how the coefficient of friction for C-110 changes with wear. Initially, μ is recorded as 0.171. After 2000 wear cycles the average value of μ increased to 0.417. This indicates that as the surface of the C-110 MicroSlick began to wear, the coating was broken in before settling into an average value for the coefficient of friction. For high use and extended wear applications μ should be taken as 0.417. For single or low use applications the value of μ is lower. Table 2 shows the values for μ compared to the coefficient of friction for some commonly used materials. Overall, C-110 MicroSlick performed as expected by lowering the coefficient of friction between two metallic substrates. This study indicates that Cerakote™ C-110 can be successfully used as a dry-film lubricant.

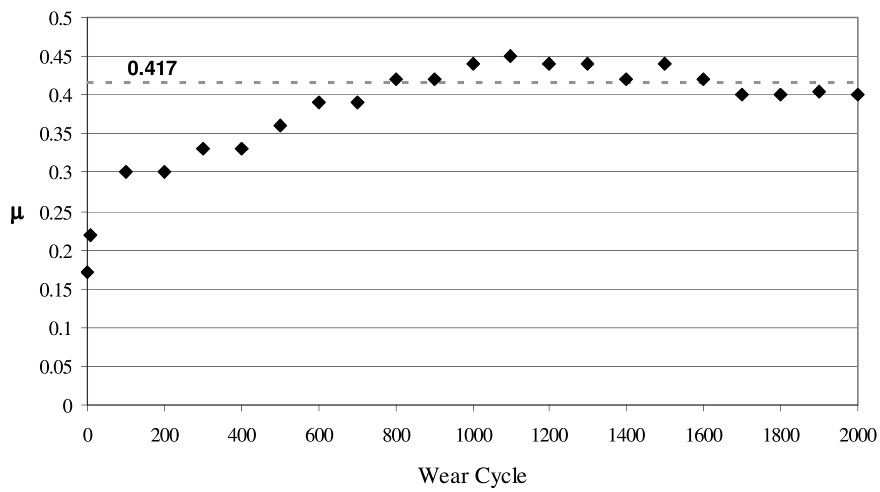

Figure 2. Variation in the coefficient of friction as a function of wear for Cerakote™ C-110 MicroSlick.

Table 2. Coefficient of kinetic friction (μ), with and without wear, for Cerakote™ C-110 MicroSlick

Sample	Initial coefficient of friction (μ)	Coefficient of friction with wear (μ)
C-110 – Stainless Steel	0.171	0.417
Steel-Steel	0.57-0.80*	-
Aluminum-Aluminum	0.8-1.2*	-

*Average coefficient of friction without wear.

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