

## ALTERATION OF STRIBECK AND TRACTION CURVES OF LUBRICANTS DUE TO ELECTRIFICATION

L. I. Farfan-Cabrera <sup>a\*</sup>, P. Lee <sup>b</sup>, C. Sanchez <sup>b</sup>, A. Erdemir <sup>c</sup>

\*farfanl@tec.mx

<sup>a</sup> Tecnologico de Monterrey, Monterrey, 64849, México

<sup>b</sup> Southwest Research Institute, San Antonio, TX 78238, USA

<sup>c</sup> Texas A&M University, Mechanical Engineering Department, College Station, TX 77843, USA

### KEYWORDS

*Mixed lubrication; Experiments in Tribology; EHL*

### ABSTRACT

The existence of shaft currents in electric vehicle drivelines is known to have serious deleterious effects in bearings and gears [1]. Therefore, a clear understanding of the sliding/rolling behavior of lubricated interfaces under electrified environments is essential. In this investigation, using three different lubricants (ATF-Dexron VI, PAO4 and Group II), numerous unelectrified and electrified tests were carried out in an MTM tester under the conditions shown in Table 1. The tests were performed over a very broad range of slide-to-roll ratios in order to determine if there would be any alteration of Stribeck and traction curves for all the lubricants tested. Each set of tests involved 12 consecutive runs (i.e., 6 Stribeck and 6 traction tests) using the same test pair and oil sample. The wear tracks generated during each set of tests were analyzed by optical profilometry, Raman spectroscopy, and SEM. In addition, electro-rheological tests were performed to determine viscosity changes due to similar electrification at 20 and 75°C. The results indicated that electrification only caused a slight increase of viscosity for the ATF, but significant alterations in the Stribeck and traction curves of all the tested oils, as shown in Fig 1.

Table 1 Slide/roll test conditions.

Test	Stribeck	Traction
SRR (%)	20	0-20
Entrainment speed (mm/s)	0.001-3900	1000
Load (N)	20	20
Temperature (°C)	20, 75	20, 75
Duration (s)	620	130
Electrical current (A)	0, 1.5, 3	0, 1.5, 3
Lubricants	Dexron VI, PAO 4 and Group II	
Test matrix	<pre>                     graph TD                         Start --&gt; S1[Stribeck test 1 20°C]                         S1 --&gt; S2[Stribeck test 2 20°C]                         S2 --&gt; S3[Stribeck test 3 20°C]                         S3 --&gt; T1[Traction test 1 20°C]                         T1 --&gt; T2[Traction test 2 20°C]                         T2 --&gt; T3[Traction test 3 20°C]                         T3 --&gt; H[Heating]                         H --&gt; S4[Stribeck test 4 75°C]                         S4 --&gt; S5[Stribeck test 5 75°C]                         S5 --&gt; S6[Stribeck test 6 75°C]                         S6 --&gt; T4[Traction test 4 75°C]                         T4 --&gt; T5[Traction test 5 75°C]                         T5 --&gt; T6[Traction test 6 75°C]                         T6 --&gt; WA[Wear analysis]                     </pre>	

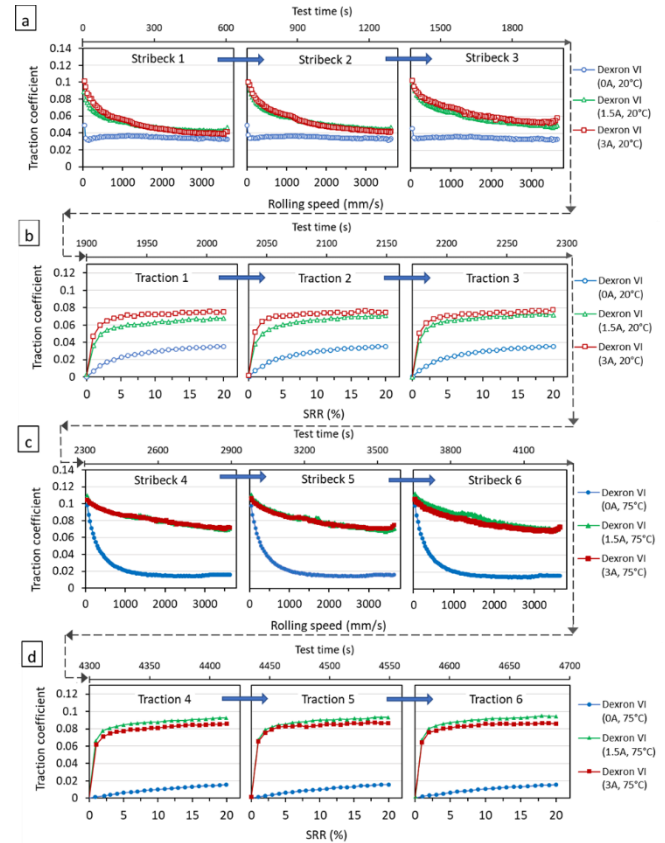


Fig.1 Stribeck and traction curves for ATF-Dexron VI.

### ACKNOWLEDGMENTS

L.I.F.C. acknowledges the financial support given by the Fulbright Visiting Scholars Program (2023-2024) and Tecnologico de Monterrey within the Challenge-based research project TM-10-475 (call 2023).

### REFERENCES

- [1] Farfan-Cabrera, L. I. and Erdemir, E., (2024) “Electric Vehicle Tribology: Challenges and Opportunities for a Sustainable Transportation Future” ELSEVIER. ISBN: 978044314075.