

Supplementary Data for “Electrified Wear in Lubricated Contacts: Effect of AC versus DC voltages”

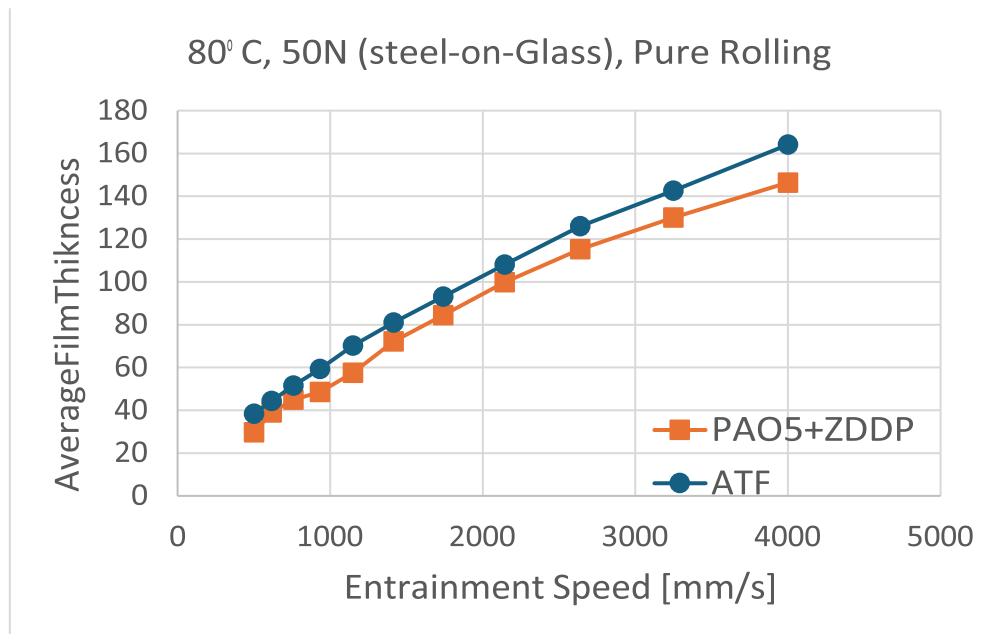


Figure S1 Average EHD film thickness measurement carried out using Ultra-thin film EHD2 setup with PAO+ZDDP and ATF. The measurements are carried out at 80 °C lube temperature, 0.48 GPa Maximum Hertzian contact pressure and in pure rolling conditions.

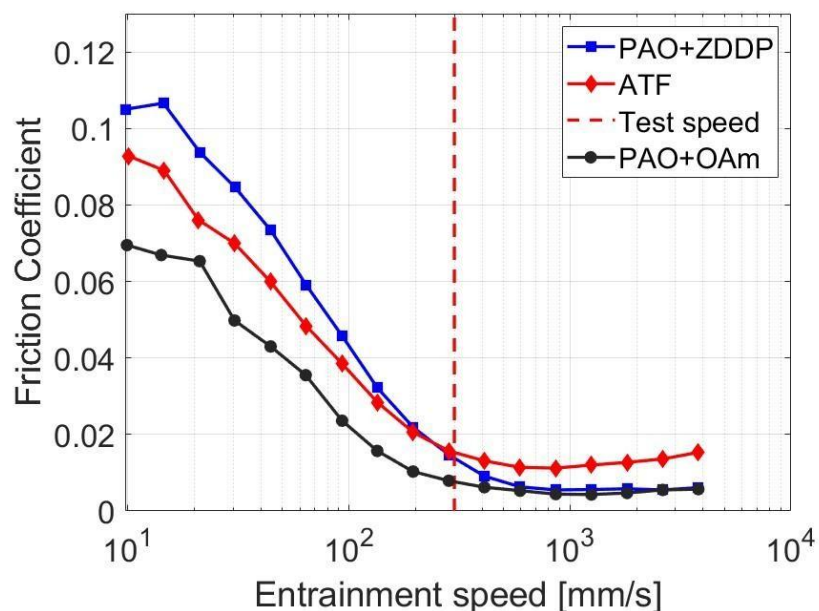


Figure S2 Stribeck curves at a contact pressure of 1 GPa, oil sump temperature of 80 °C, and SRR of 5% for each test oil.

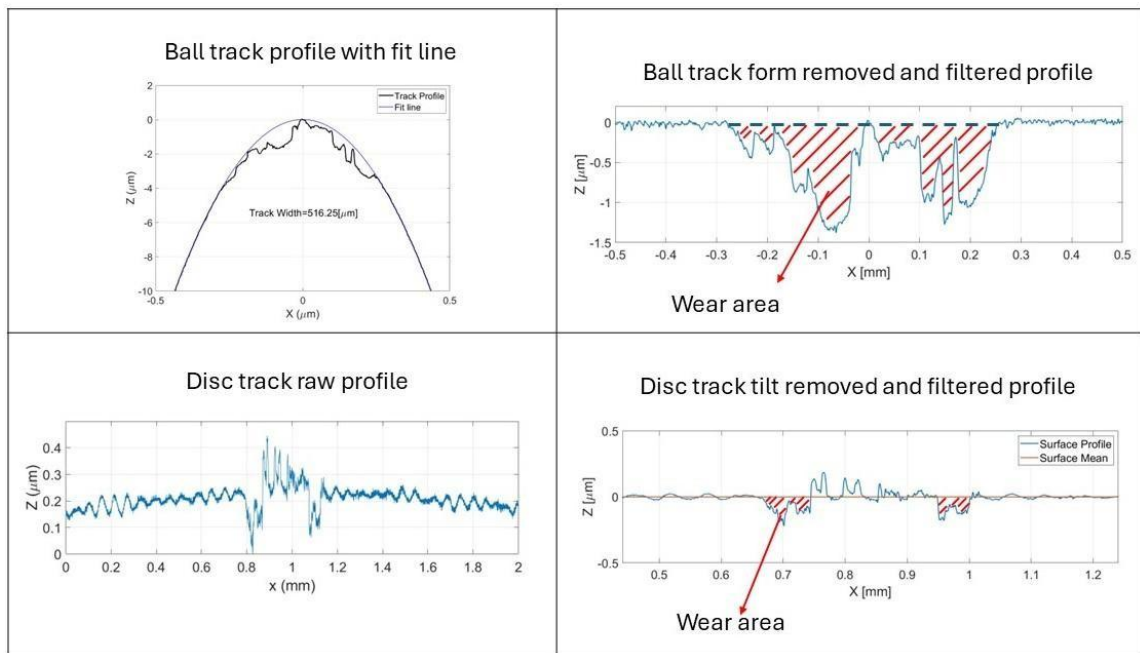


Figure S3. Wear area calculation using 2D wear track profiles measured on a stylus profilometer.

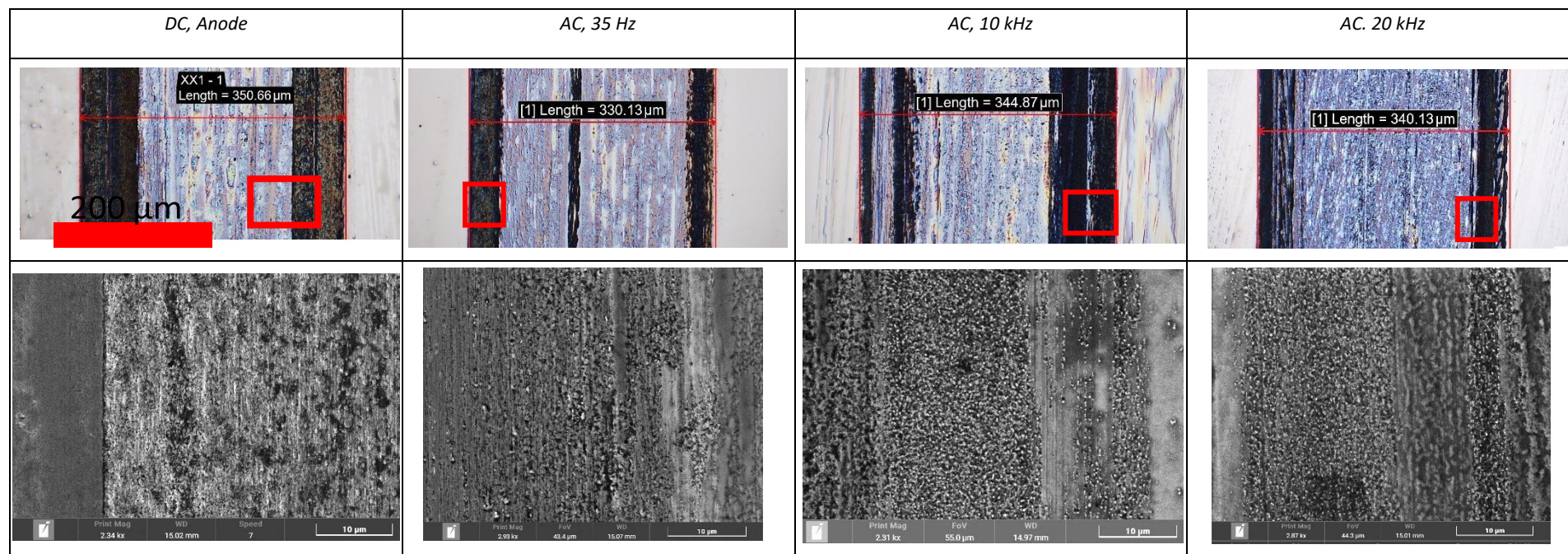


Figure S4. Disc track optical microscope images (top row) and SEM images (bottom row from tests with PAO+ZDDP. The images are presented from DC voltage-disc anodic test and AC voltage tests at frequencies: 35 Hz, 10 kHz, and 20 kHz. The red box in each microscope image shows the region where the corresponding SEM image was acquired.

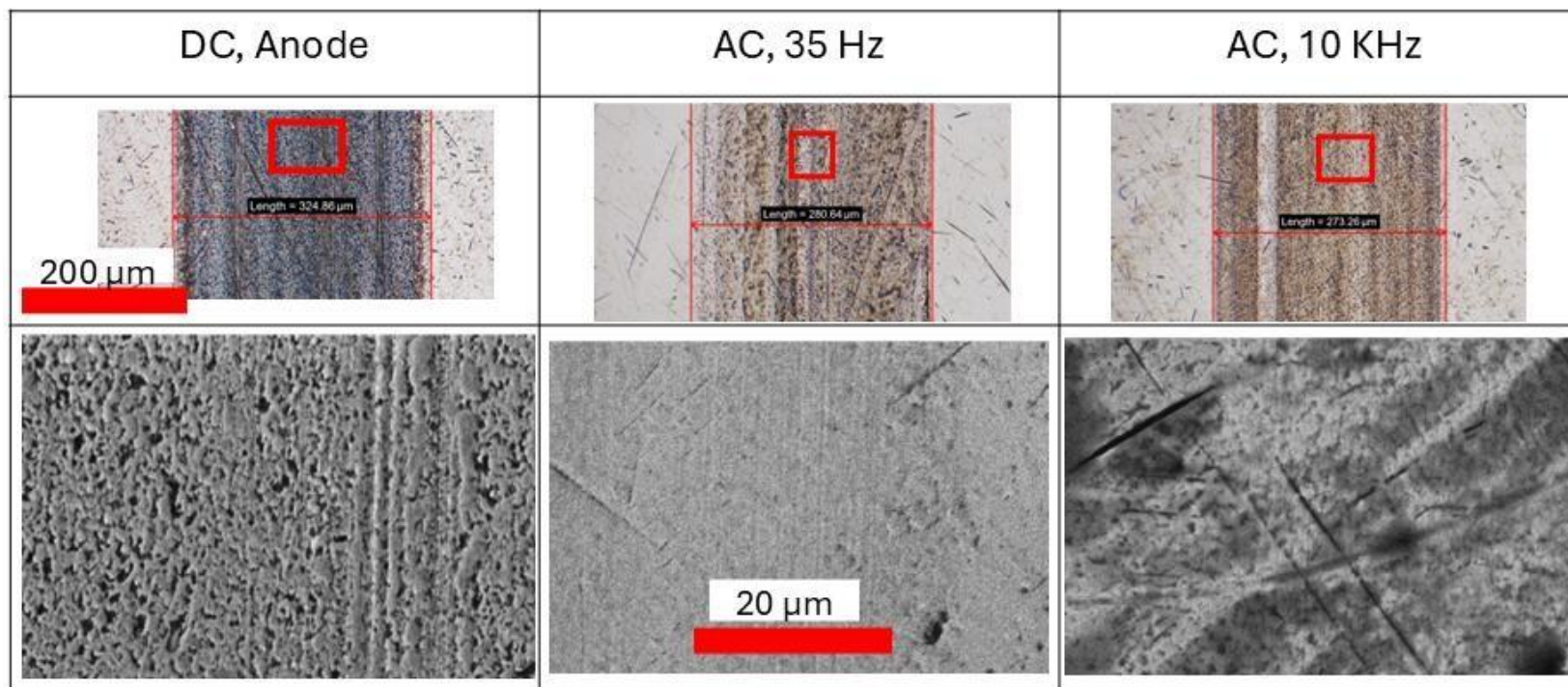


Figure S5. Ball track optical microscope images (top row) and SEM images (bottom row from tests with PAO+OAm). The images are presented from DC voltage-ball anodic test and AC voltage tests at frequencies: 35 Hz, and 10 kHz. The red box in each microscope image shows the region where the corresponding SEM image was acquired.

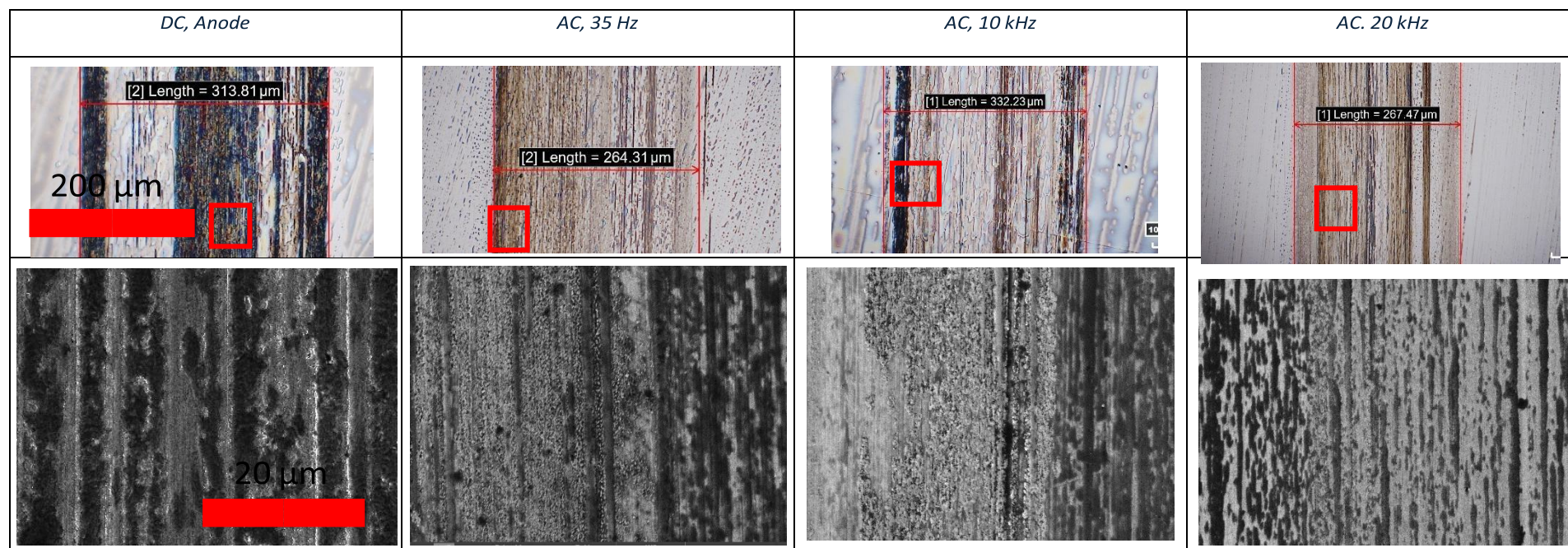


Figure S6. Disc track optical microscope images (top row) and SEM images (bottom row) from tests with ATF. The images are presented from DC voltage-disc anodic test and AC voltage tests at frequencies: 35 Hz, 10 kHz, and 20 kHz. The red box in each microscope image shows the region where the corresponding SEM image was acquired.

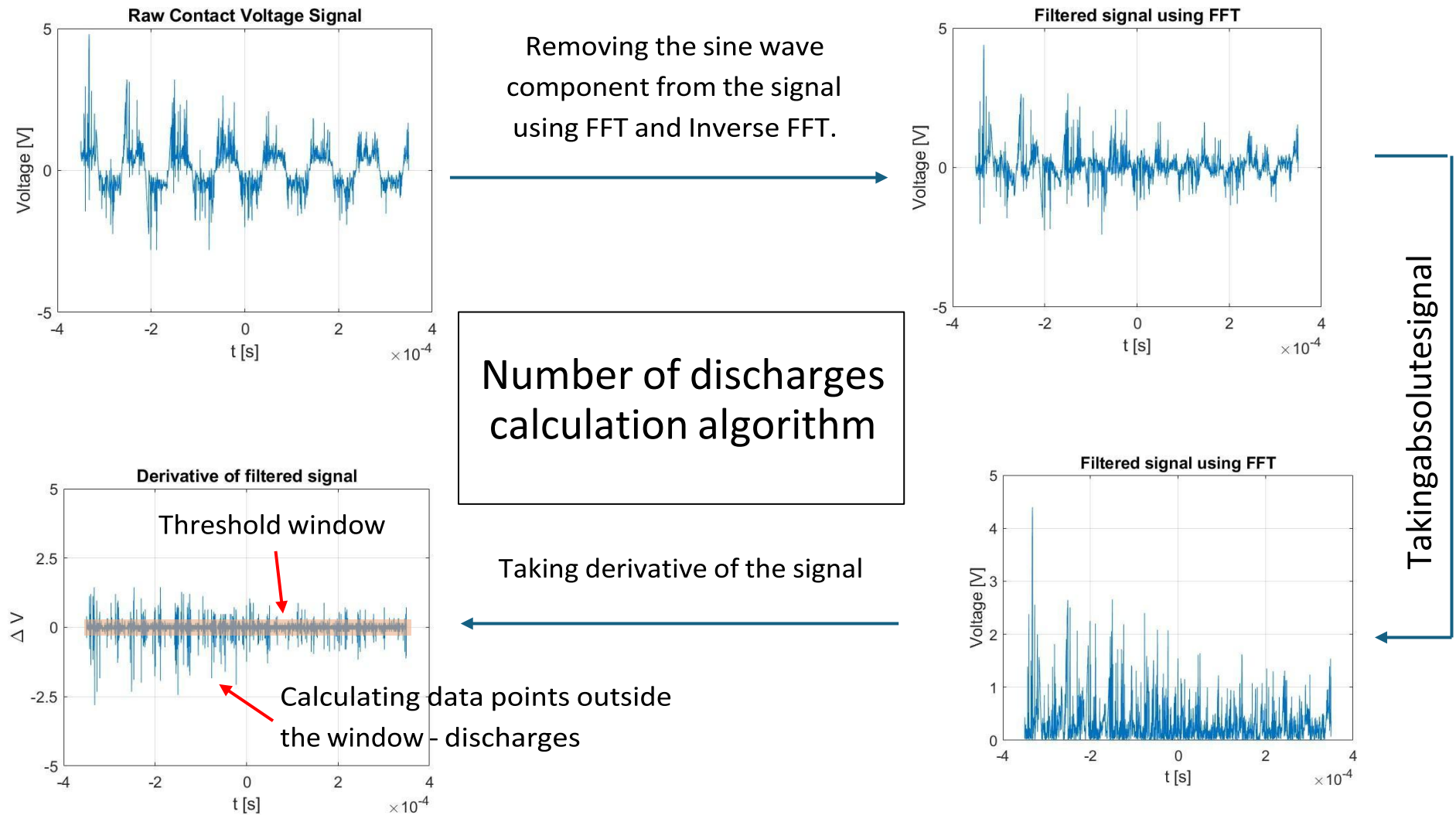
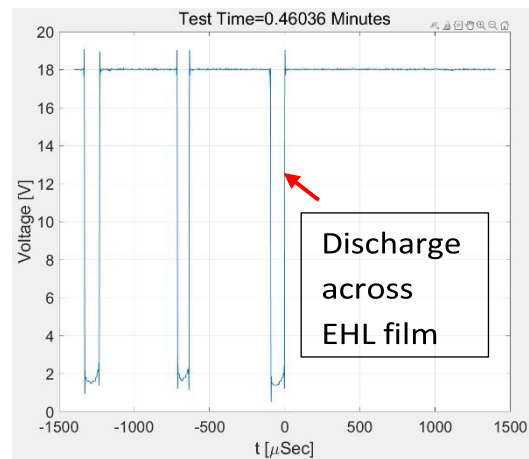
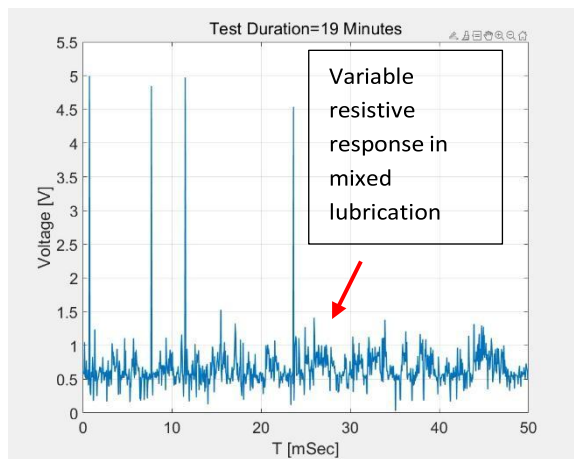


Figure S7. Representation of algorithm to calculate number of discharges from contact voltage signals.

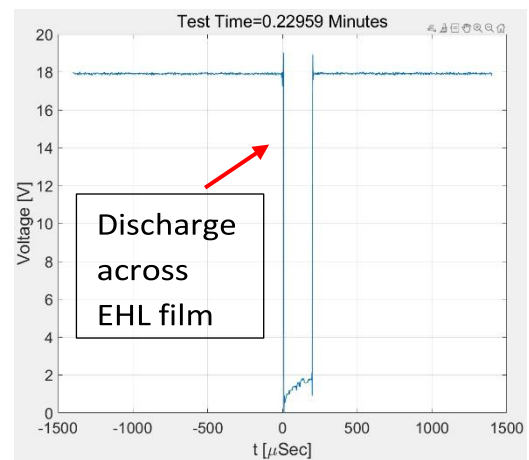
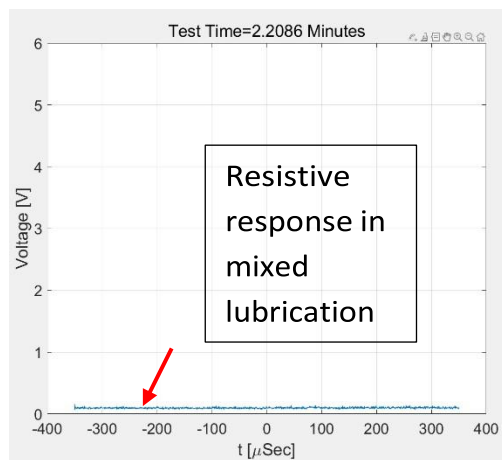
Table S1 Comparison of contact voltage between mixed lubrication regime ($\Lambda \approx 0.8$) and full-film EHL regime ($\Lambda \approx 28$). The full-film EHL regime is achieved using high viscosity PAO base oil (322 mPa.s at 40 °C) compared to the one used in mixed lubrication tests (20.5 mPa.s at 40 °C).

	Mixed lubrication ($\Lambda \approx 0.8$)	Full-film lubrication ($\Lambda \approx 28$)
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PAO+ZDDP



PAO+OAm



Ball

Disc

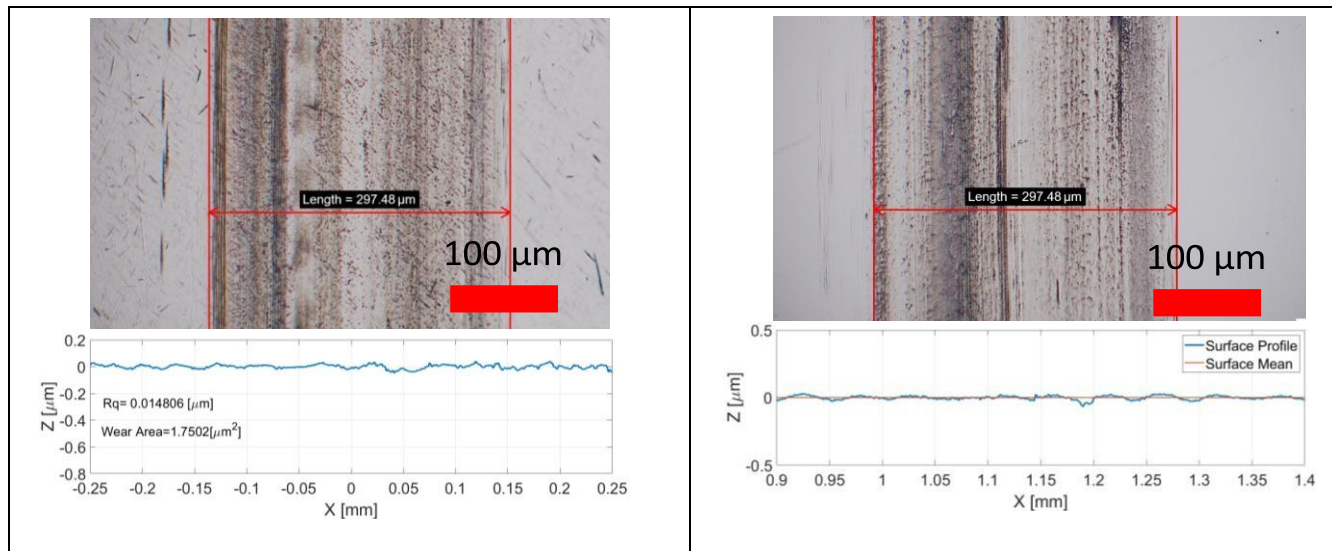


Figure S8. Optical microscope images and surface profiles of ball and disc wear tracks from the test with PAO+OAm in 0.1 Hz square wave AC test with $\pm 5V$ and ± 10 mA current.

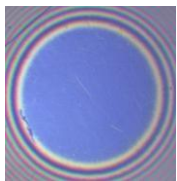
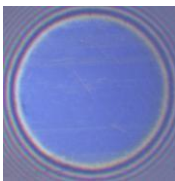
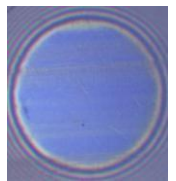
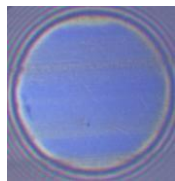
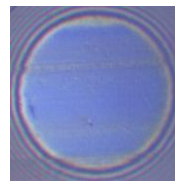
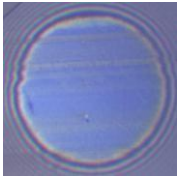
Time (minutes)	0	15	180	300	420	720
AC 10V p-p f= 0.1 Hz						

Figure S9. SLIM images of the ball track captured during the test with PAO+OAm in 0.1 Hz square wave AC test.