

Experiment Number 20

Can we use a pin-on-twin test configuration to evaluate DLC coating life?

Test Conditions

Upper Pin:	7 mm diameter x 30 mm long DLC coated pin
Lower Pins:	6 mm diameter x 40 mm nitride pins
Stroke:	25 mm
Frequency:	5 Hz
Test Fluid:	Low lubricity reference diesel fuel
Temperature:	30 C
Test 1:	Load ramped from 40 N to 200 N in 20 N steps
Test 2:	Fixed load: 50 N

Results - Test 1

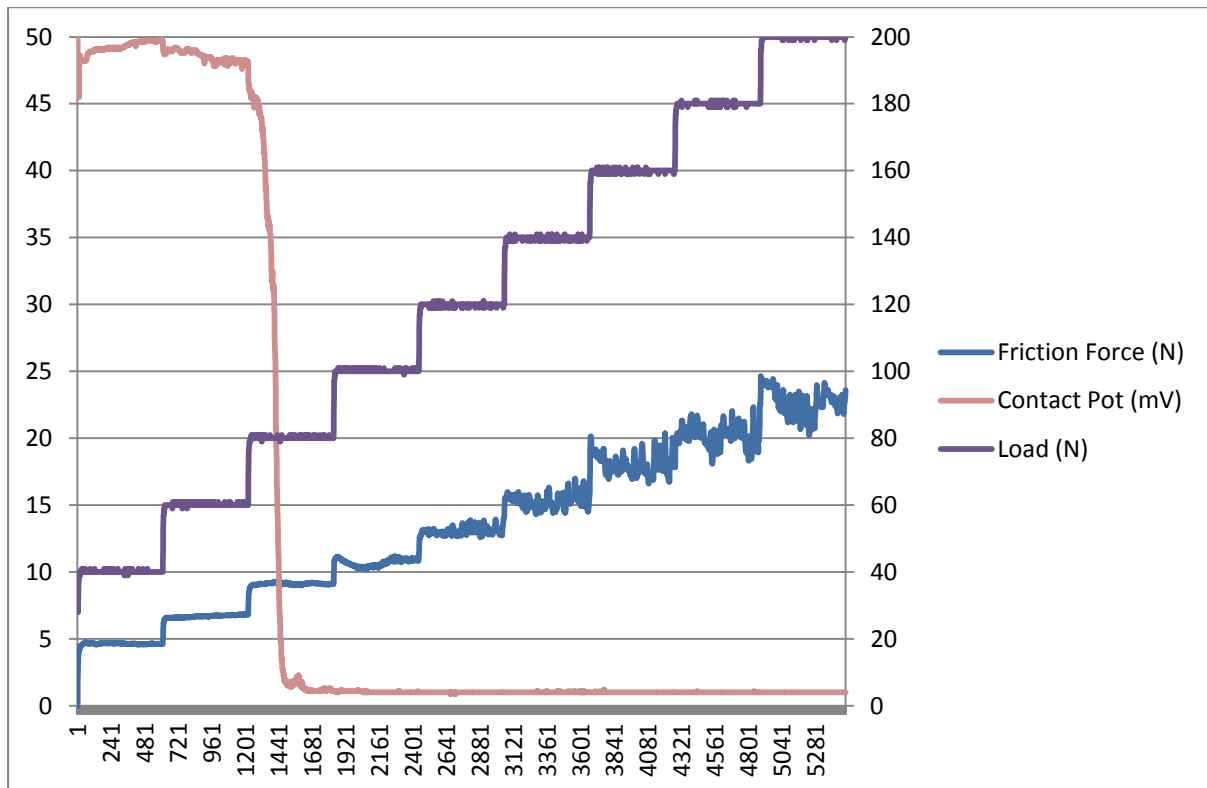


Figure 1: Friction force and contact potential with ramped load

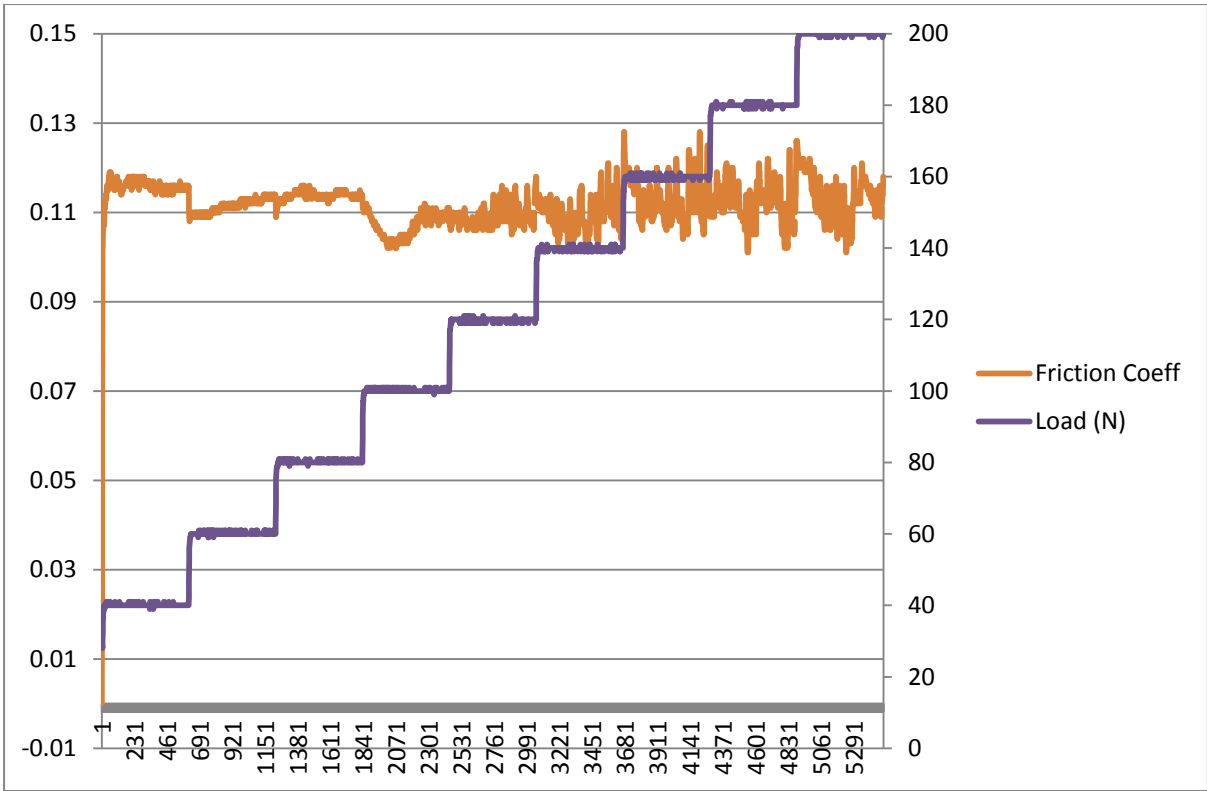


Figure 2: Friction coefficient with ramped load

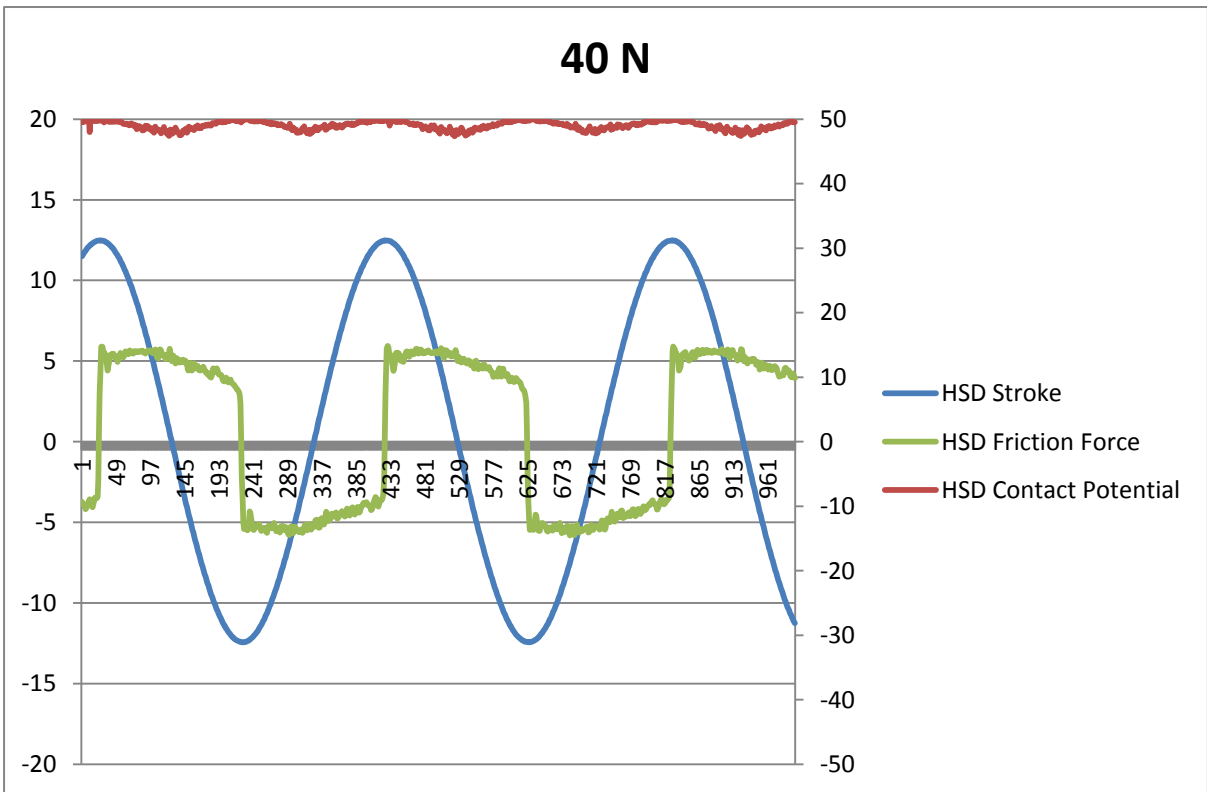


Figure 3: High speed data at 40 N

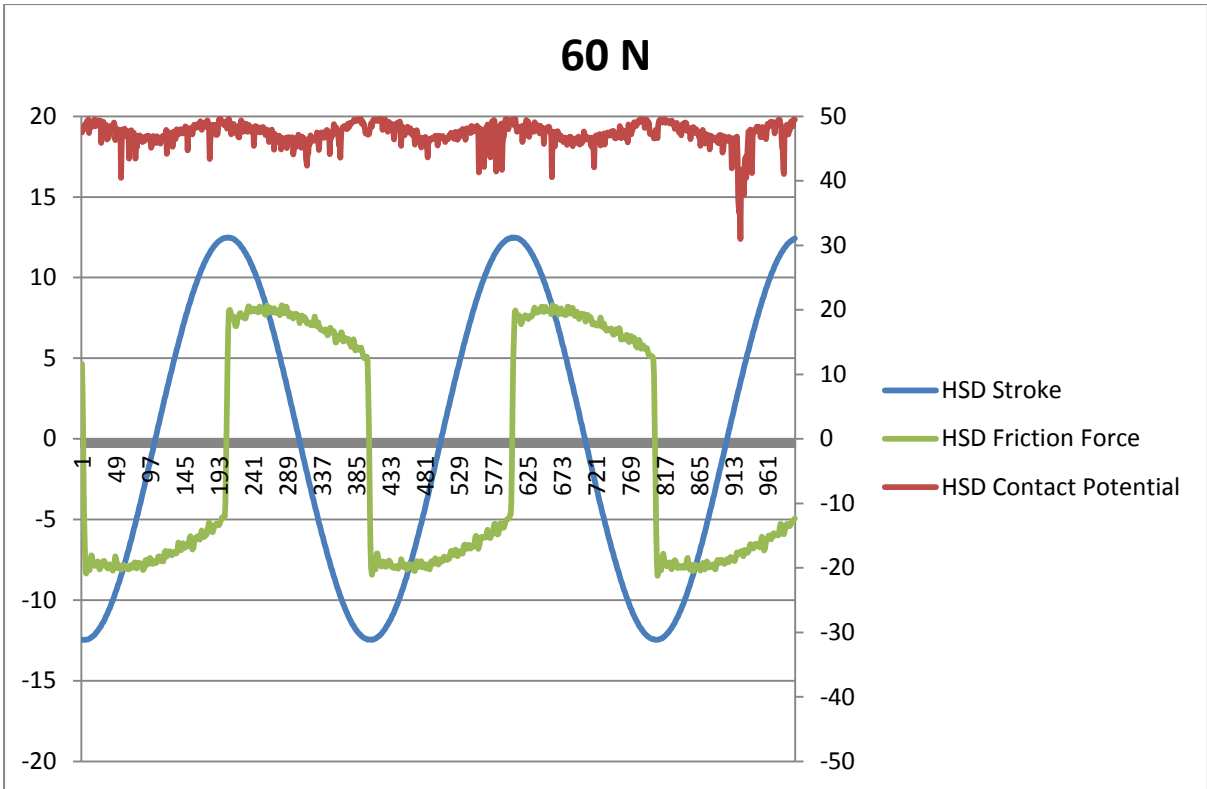


Figure 4: High speed data at 60 N

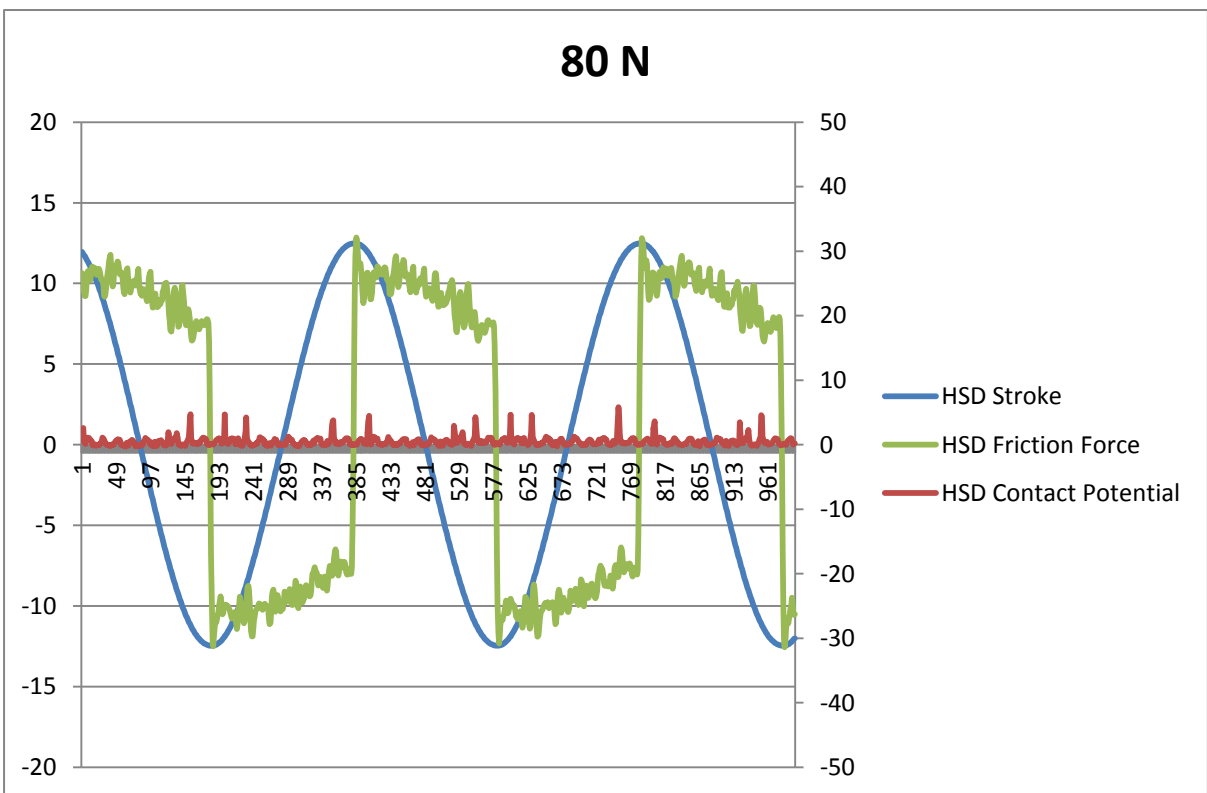


Figure 5: High speed data at 80 N

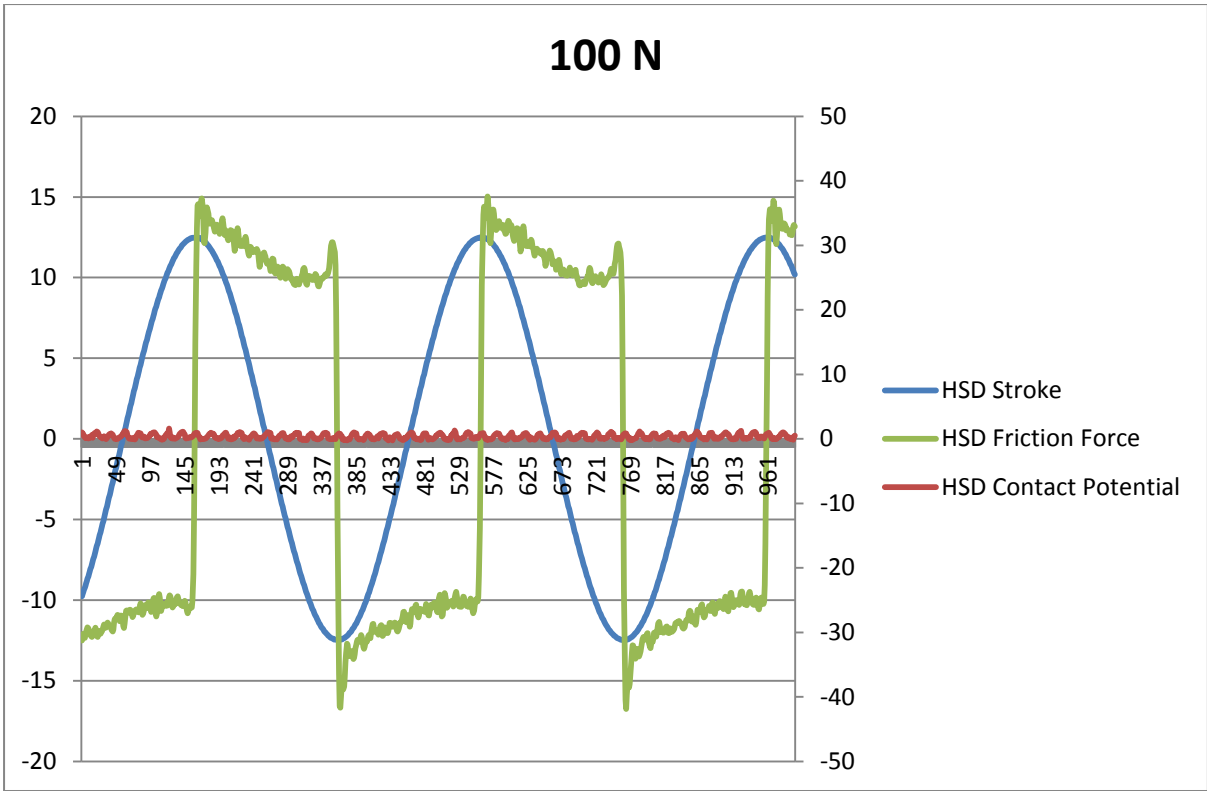


Figure 6: High speed data at 100 N

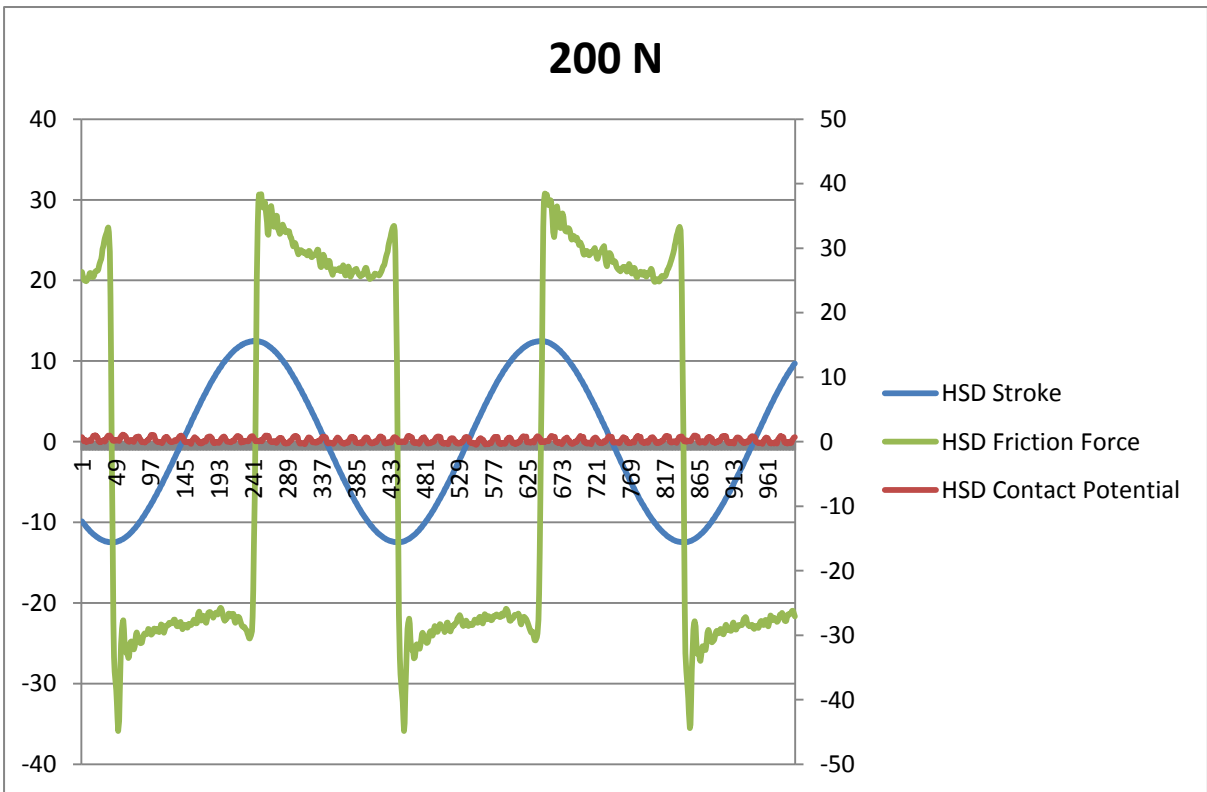


Figure 7: High speed data at 200 N

Comments

At 40 N and 60 N the contact remains non-electrically conducting, with the highest contact resistance apparent at stroke ends. The instantaneous friction appears to be velocity dependent with a negative Stribeck curve (friction increasing with velocity). At 80 N, the contact potential falls to zero and a further load increment causes the r.m.s. friction to become much less smooth. High speed data at 100 N and 200 N shows more conventional behaviour, with a large static friction peak at the beginning of the stroke, with friction falling with increasing velocity.

Results - Test 2

Having established a transition in contact response at 80 N, a second test was run at a fixed load of 50 N, to determine whether the contact resistance measurement could be used as a measure of coating life.

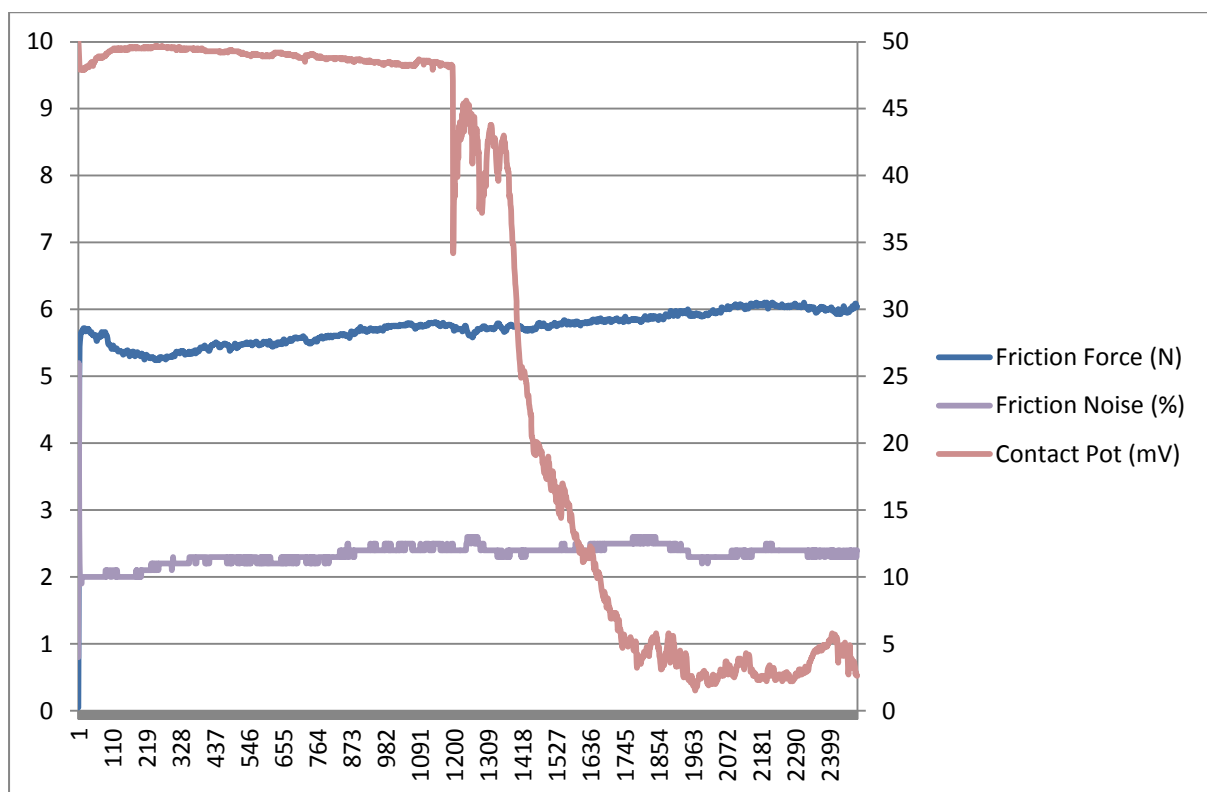


Figure 8: Fixed load test at 50 N

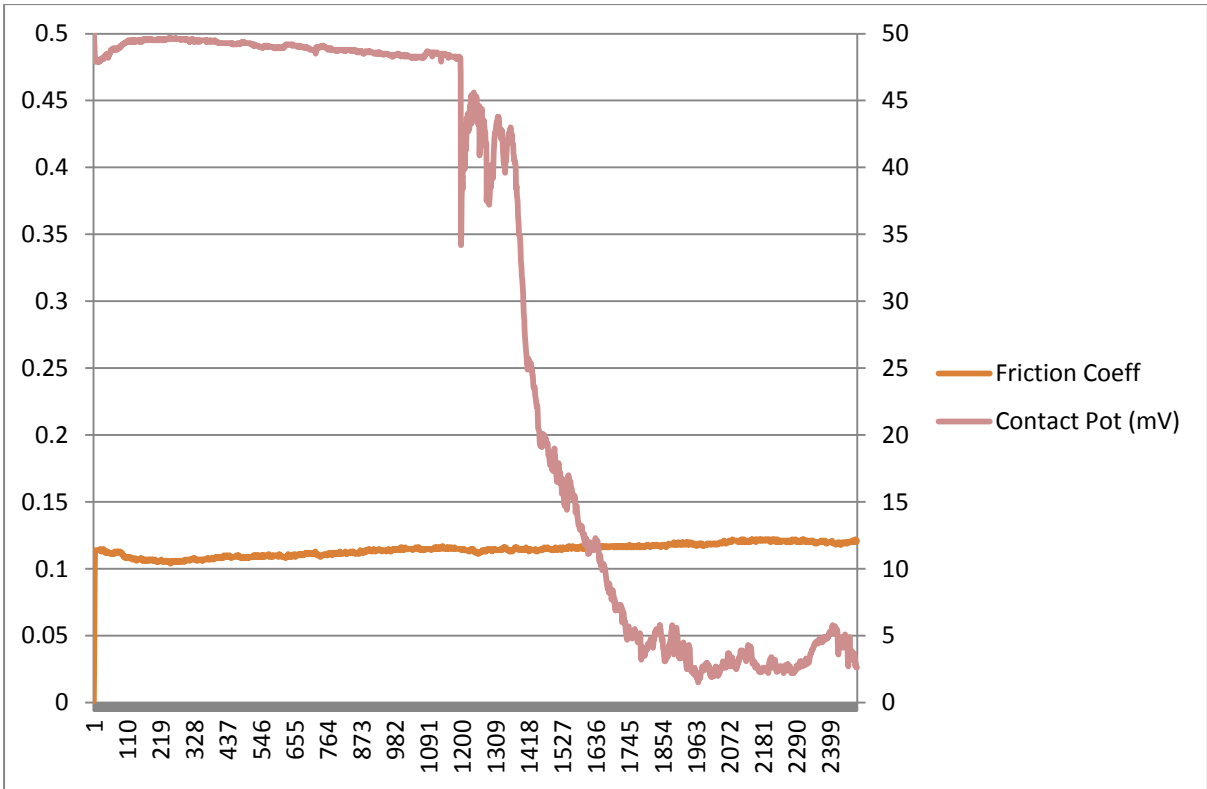


Figure 9: Fixed load test at 50 N

Comments

The coating lasted for approximately 6,000 cycles before a sharp fall in electrical contact potential indicated penetration of the non-conducting film. The fall in contact potential was accompanied by a small rise in friction, but no significant increase in friction noise, indicating that the contact continued to operate with orderly friction.