lubricants

MDPI

Supplementary Materials

Experimental analysis of friction and wear of self-lubricating composites used for dry lubrication of ball bearing for space applications

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Figure S1. Roller specimen

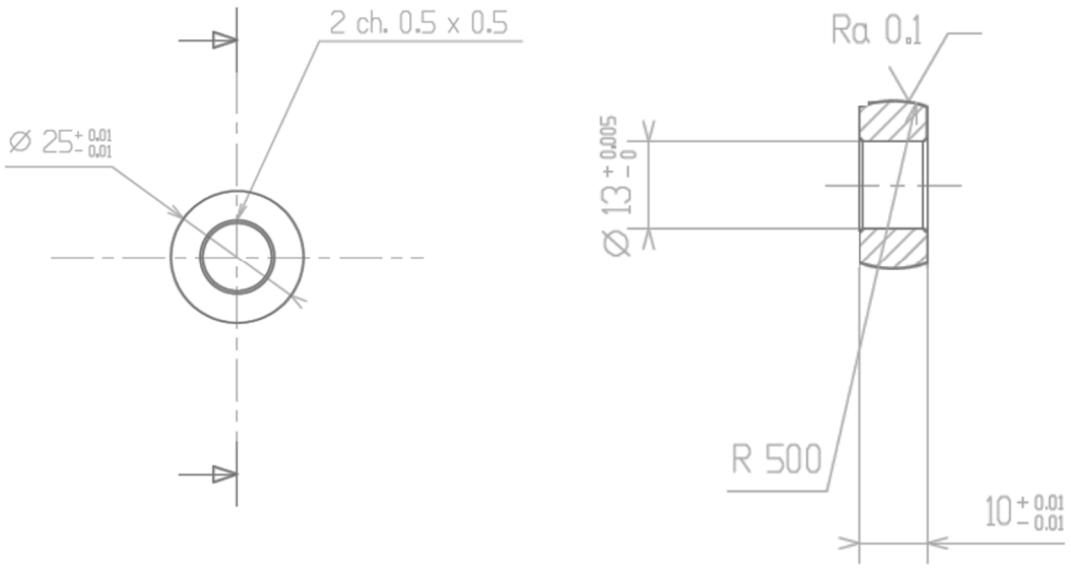
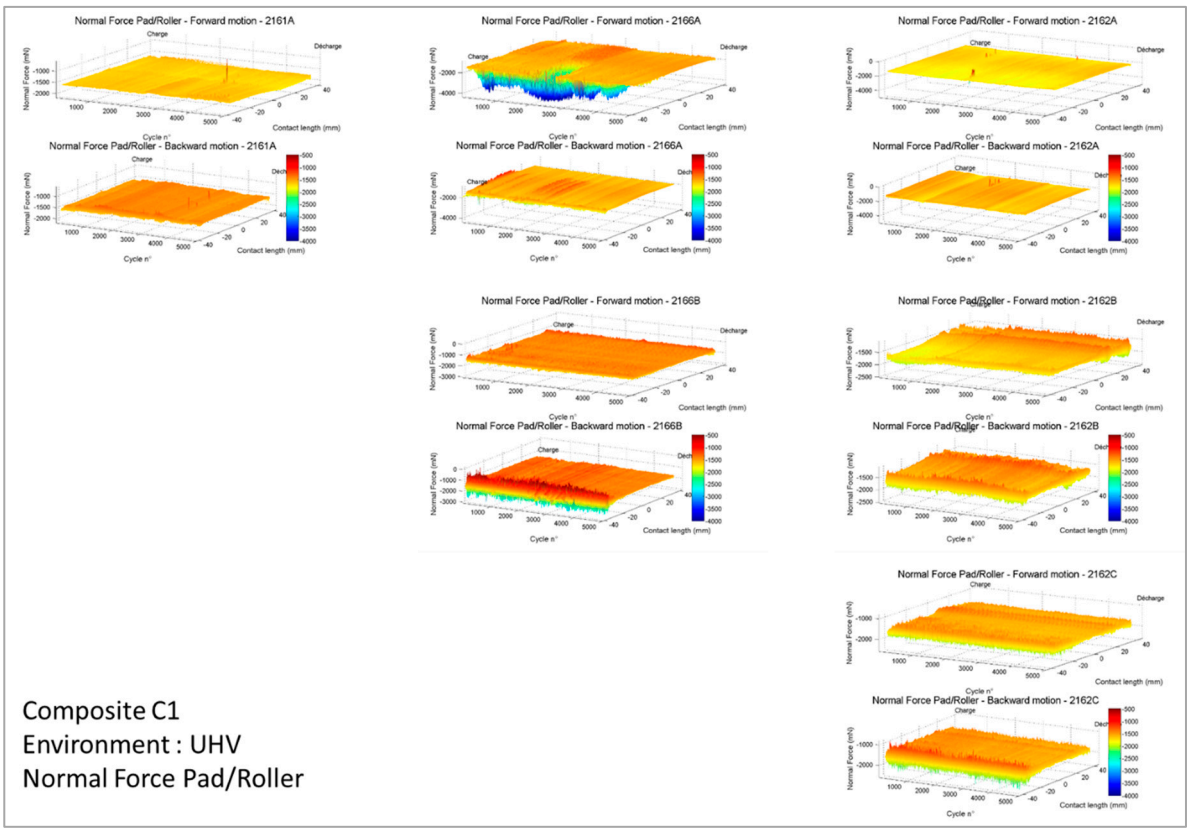
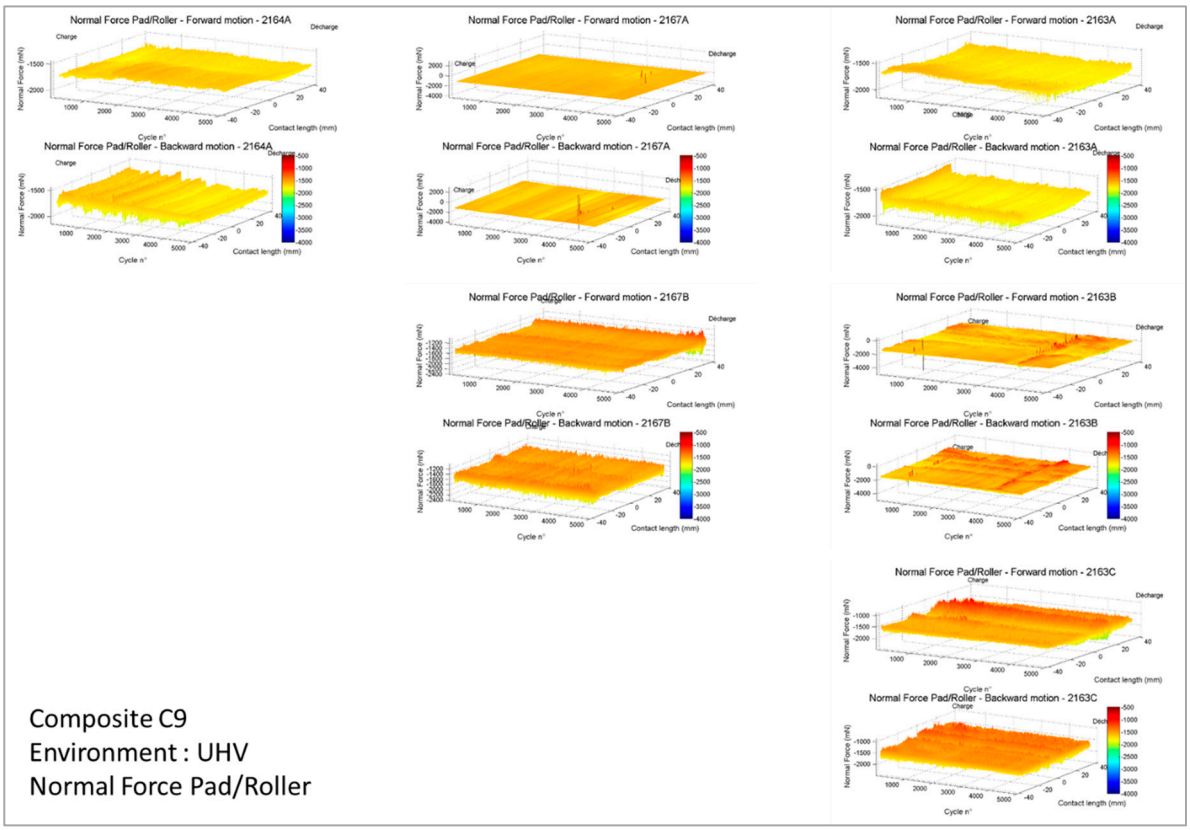
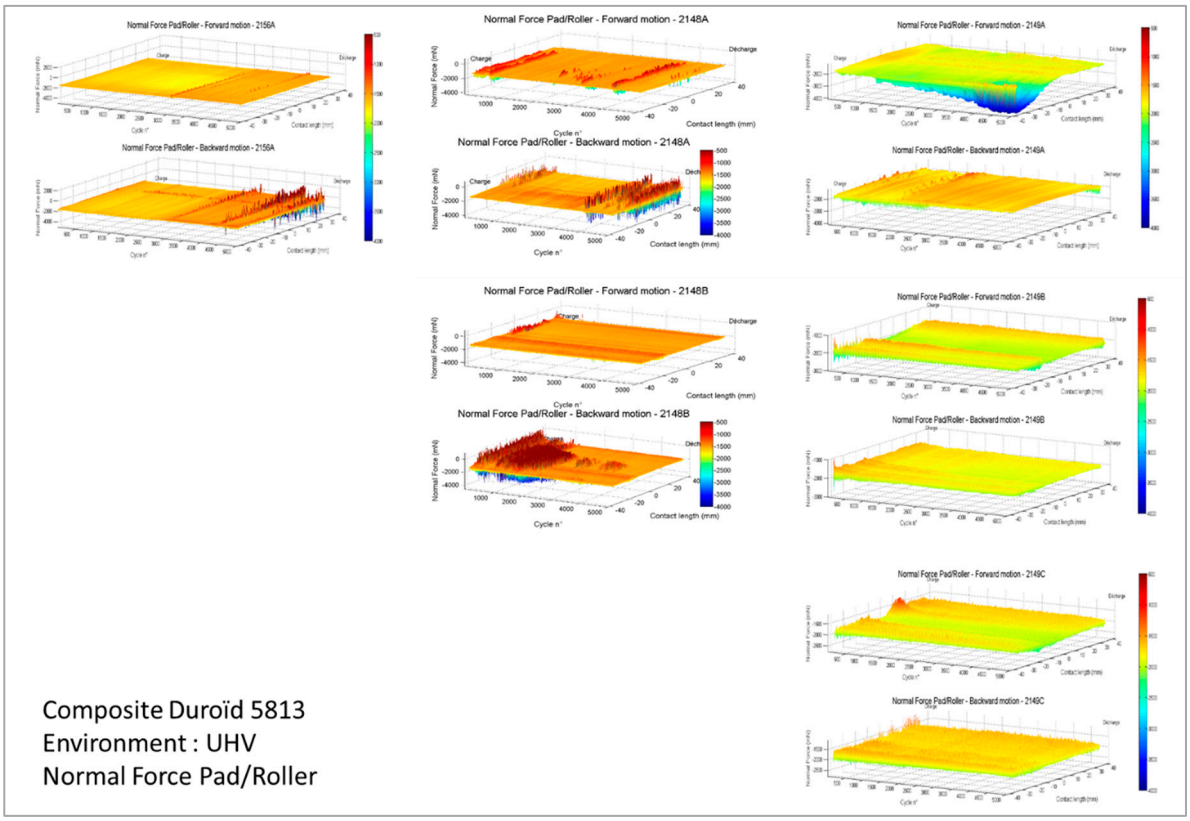


Figure S2. Friction forces F1 during test in UHV






Normal Force Pad/Roller - Forward motion - 2156A
Normal Force Pad/Roller - Backward motion - 2156A
Normal Force Pad/Roller - Forward motion - 2148A
Normal Force Pad/Roller - Backward motion - 2148A
Normal Force Pad/Roller - Forward motion - 2149A
Normal Force Pad/Roller - Backward motion - 2149A
Normal Force Pad/Roller - Forward motion - 2148B
Normal Force Pad/Roller - Backward motion - 2148B
Normal Force Pad/Roller - Forward motion - 2149B
Normal Force Pad/Roller - Backward motion - 2149B
Normal Force Pad/Roller - Forward motion - 2149C
Normal Force Pad/Roller - Backward motion - 2149C
Composite Duroïd 5813
Environment : UHV
Normal Force Pad/Roller

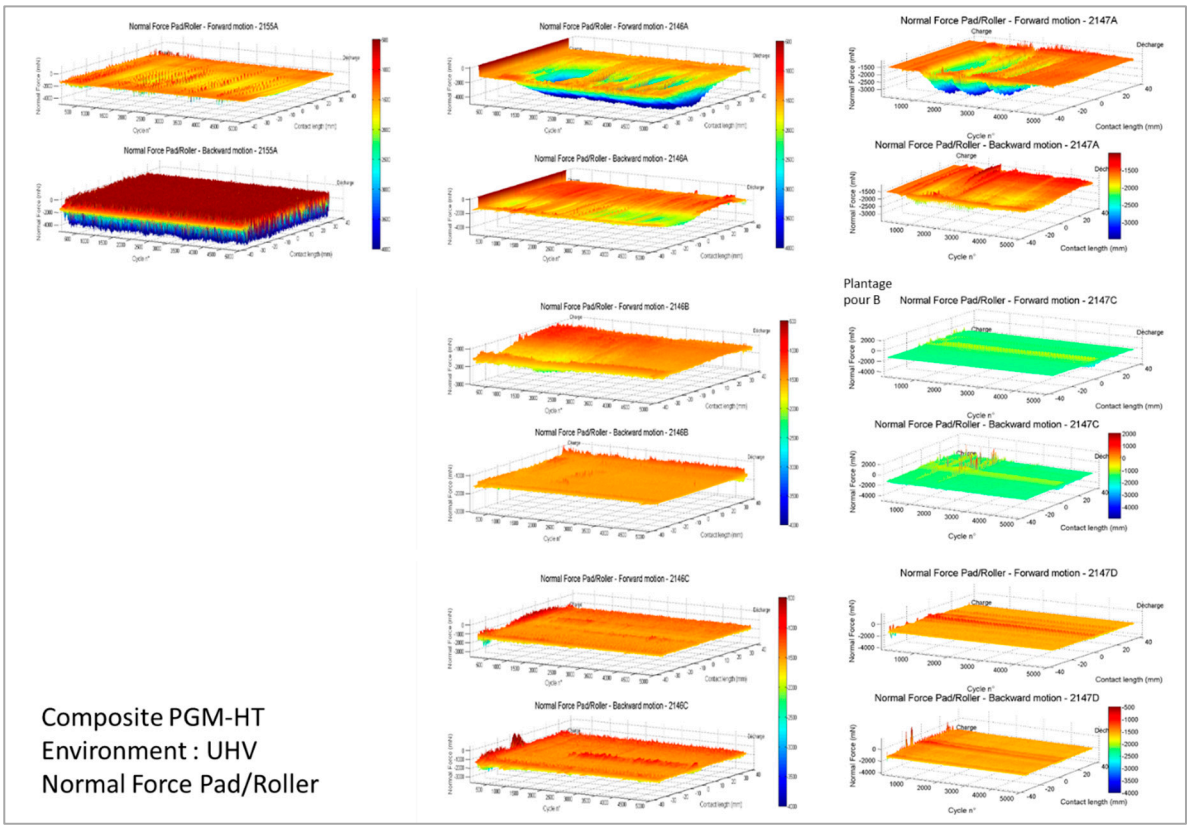

Normal Force Pad/Roller - Forward motion - 2155A
Normal Force Pad/Roller - Backward motion - 2155A
Normal Force Pad/Roller - Forward motion - 2146A
Normal Force Pad/Roller - Backward motion - 2146A
Normal Force Pad/Roller - Forward motion - 2147A
Normal Force Pad/Roller - Backward motion - 2147A
Plantage
pour B
Normal Force Pad/Roller - Forward motion - 2146B
Normal Force Pad/Roller - Backward motion - 2146B
Normal Force Pad/Roller - Forward motion - 2147C
Normal Force Pad/Roller - Backward motion - 2147C
Normal Force Pad/Roller - Forward motion - 2146C
Normal Force Pad/Roller - Backward motion - 2146C
Normal Force Pad/Roller - Forward motion - 2147D
Normal Force Pad/Roller - Backward motion - 2147D
Composite PGM-HT
Environment : UHV
Normal Force Pad/Roller

Figure S3. Friction force F1 during tests in Air 50%HR

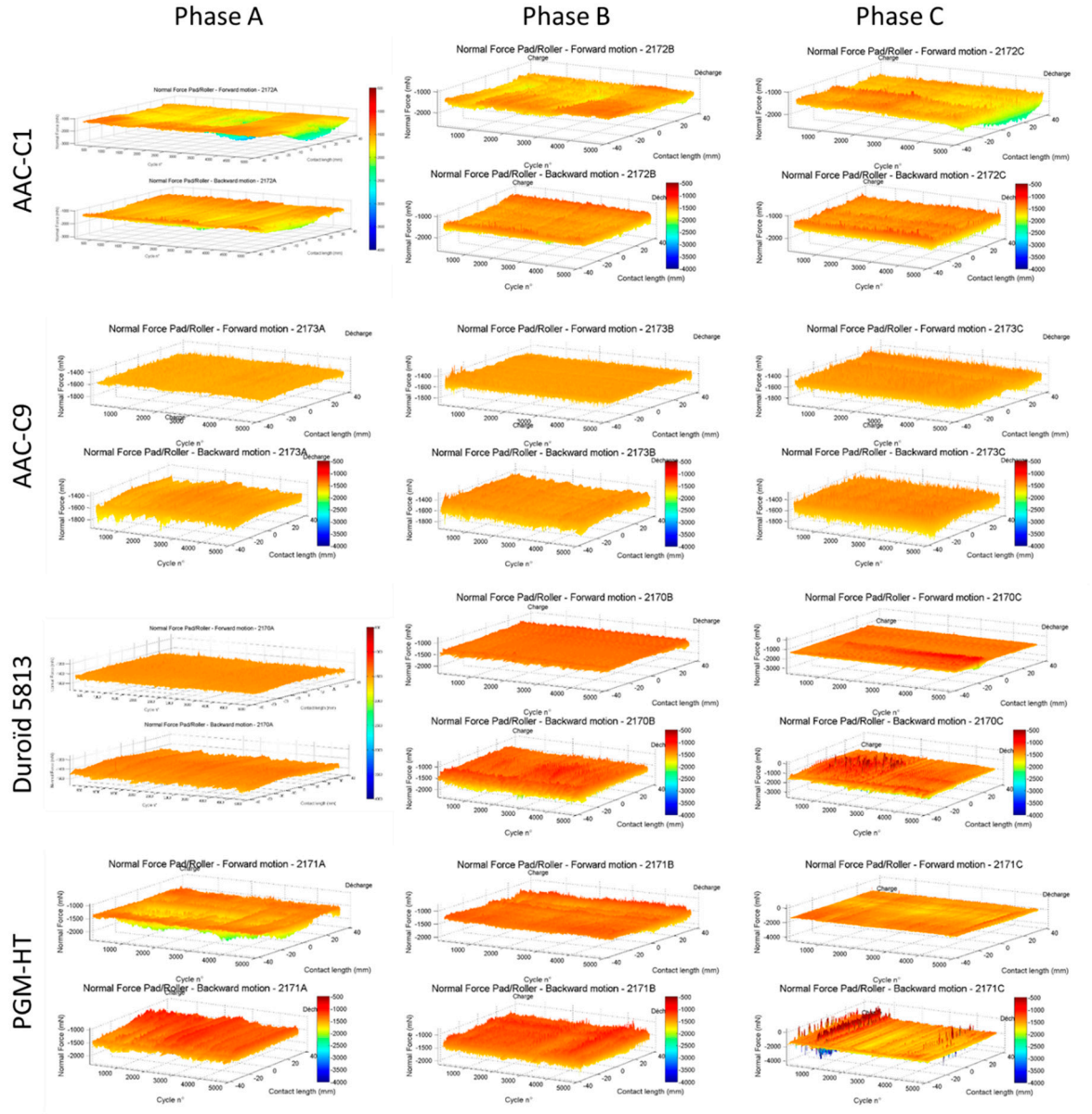


Figure S4. Picture and optical microscope images of the roller after Phase A test in UHV

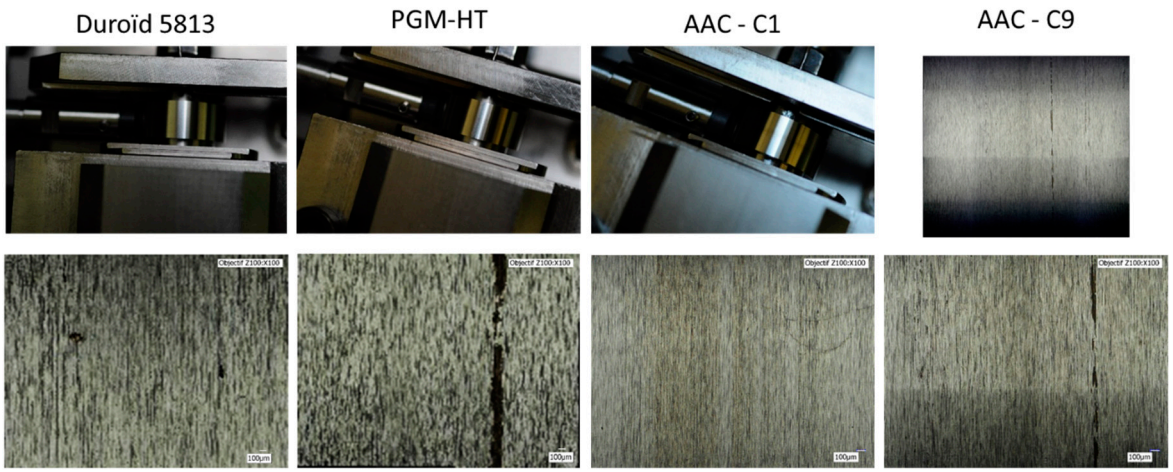
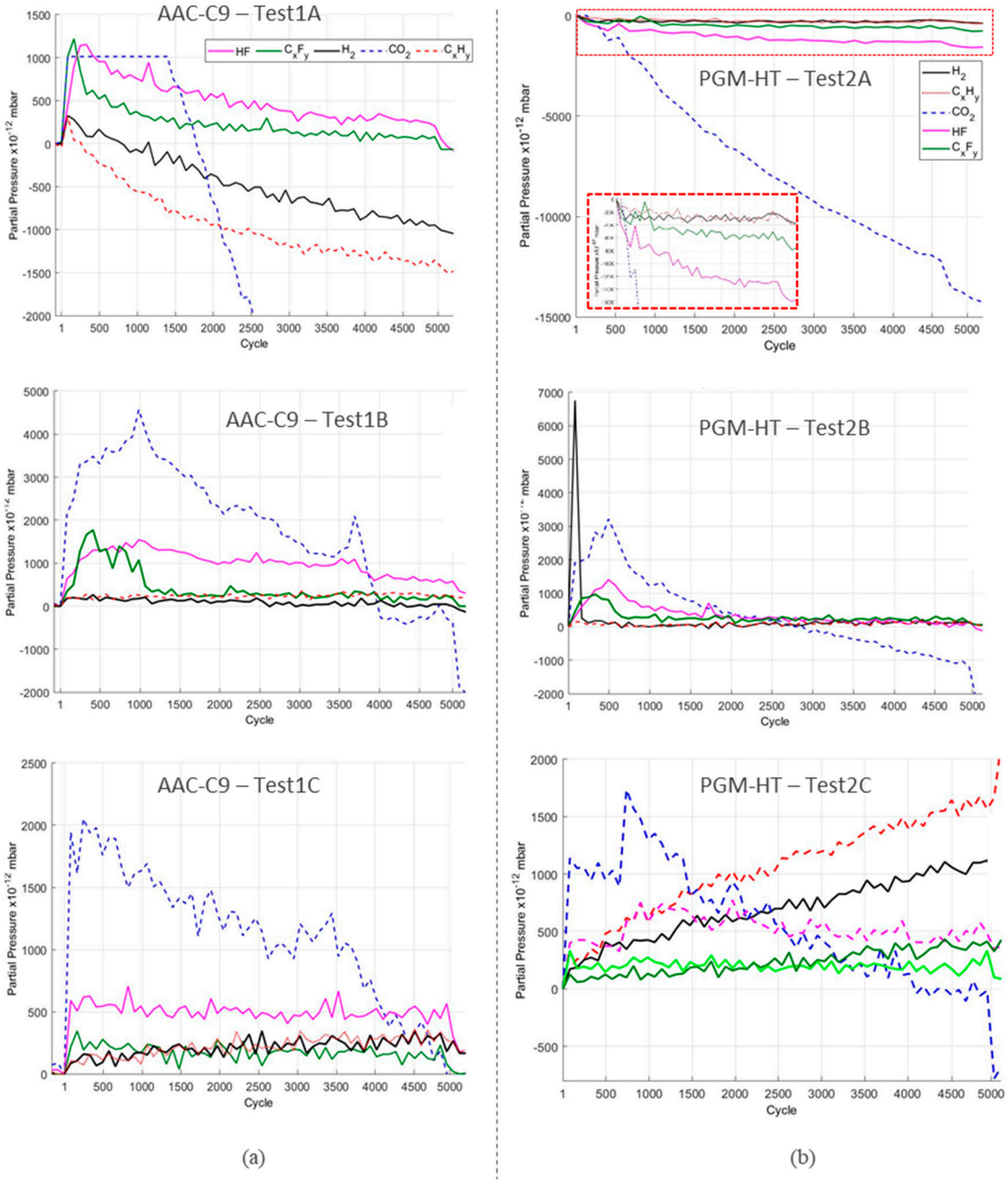
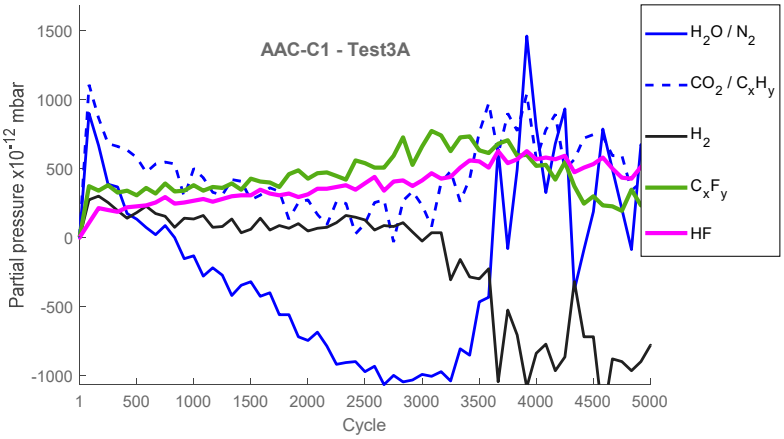


Figure S5. Mass Spectra of PGM-HT and AAC-C9 composites



Spectrum from AAC-C1 composite under friction in vacuum that shows water adsorption:



S6. Probable error sources of the experimental data

In the tribological tests, error in the measure are expected to mostly come from both the mass spectrometer and force sensors. It is difficult to assess the error in the partial pressure measurements. However, the pressure given by the mass spectrometer is similar in value to the pressure given by the pressure gauge of the chamber. Moreover, the 10^{-12} mbar range is higher than the lowest detection limit of the equipment. Nonetheless, there are unknown parameters relatively to the position of the quadrupole of mass spectrometer as compared to both the flange connected to the pump and the contact. Therefore, we decided to only discuss the results qualitatively and to use only relative comparisons of detection levels to avoid any possible errors in quantification of molecules levels.

Regarding the adhesion measurement, we may face positioning error with the AFM. It is estimated at max 0.5% of the largest dimension of the scanned area, which means here and error of 350nm, i.e. ±175nm around the chosen location. Considering the dimensions (few micrometers in size) of the features on which adhesion is measured, and the fact that we targeted the center of those features, we are not impacted by such error.