**Appendix**

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| --- | --- |
| **C:\Users\febinc\Desktop\Matlab\FTIR\PAO Tested and untested oil.emf** | **C:\Users\febinc\Desktop\Matlab\FTIR\Ester oil Tested and untested oil.emf** |

Figure A: FT-IR data for tested and untested samples, a) PAO and b) ester oil.

|  |  |
| --- | --- |
| **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\5-40 P Base oil.emf** | **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\5-40 N Base oil.emf** |
| **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\40-100 P Base oil.emf** | **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\40-100 N Base oil.emf** |
| **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\100-200 P Base oil.emf** | **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\100-200 N Base oil.emf** |
| **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\200-300 P Base oil.emf** | **C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\200-300 N Base oil.emf** |

Figure B: ToF-SIMS positive (left) and negative (right) ion spectra of steel surface lubricated with PAO and ester oil.

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| --- | --- |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\5-40 P Oleamide.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\5-40 N Oleamide.emf |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\40-100 P Oleamide.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\40-100 N Oleamide.emf |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\100-200 P Oleamide.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\100-200 N Oleamide.emf |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\200-300 P Oleamide.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\200-300 N Oleamide.emf |

Figure C: Positive (left) and negative ion spectra (right) of oleamide derived tribofilms in PAO and ester oil (\* characteristic peaks of oleamide).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total | S- | PO2- | FeO- | Total | S- | PO2- | FeO- |
|  | PAO + ZDDP | | | | Ester oil + ZDDP | | | |
| (x,y) all |  |  |  |  |  |  |  |  |
| Depth a (x,y) |  |  |  |  |  |  |  |  |
| Depth b (x, y) |  |  |  |  |  |  |  |  |
| Mid-point cross sectional x, z scan |  |  |  |  |  |  |  |  |
|  | PAO + ZDDP + GMO | | | | Ester oil + ZDDP + GMO | | | |
| (x,y) all |  |  |  |  |  |  |  |  |
| Depth a (x,y) |  |  |  |  |  |  |  |  |
| Depth b  (x, y) |  |  |  |  |  |  |  |  |
| Mid-point cross sectional x, z scan |  |  |  |  |  |  |  |  |
|  | PAO + ZDDP + oleamide | | | | PAO + ZDDP + Oleamide | | | |
| (x,y) all |  |  |  |  |  |  |  |  |
| Depth a (x,y) |  |  |  |  |  |  |  |  |
| Depth b (x, y) |  |  |  |  |  |  |  |  |
| Mid-point cross sectional x, z scan |  |  |  |  |  |  |  |  |

Figure D: 3-D analysis from 100 x 100 µm2 analysis area of total x, y scans, at two given depth (a & b) and mid-point cross-sectional x, z scans of selected ions for different samples within wear scar.

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| --- | --- |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\5-40 P Oleamide + ZDDP.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\5-40 N Oleamide + ZDDP.emf |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\40-100 P Oleamide + ZDDP.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\40-100 N Oleamide + ZDDP.emf |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\100-200 P Oleamide + ZDDP.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\100-200 N Oleamide + ZDDP.emf |
| C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\200-300 P Oleamide + ZDDP.emf | C:\Users\febinc\Desktop\Matlab\TOF-SIMS\Manuscript 4\200-300 N Oleamide + ZDDP.emf |

Figure E: Positive (left) and negative ion spectra (right) of ZDDP + oleamide derived tribofilms in PAO and ester oil (\* characteristic peaks of ZDDP).