**XAFS data**

The XAFS raw data files are numbered according to the list below and can be found in the zip file ‘MoOx\_Al2O3 XAFS data’. These files were imported into Athena, where they were aligned to the Mo foil reference also included in these raw data files. Origin was then used to produce the figures in the paper.

|  |  |
| --- | --- |
| **Starting file number** | **Experimental conditions** |
| 172091 | 500C Helium |
| 172097 | 1st ODP step |
| 172137 | O2/He |
| 172179 | Propane dehydrogenation |
| 172231 | 2nd OPD step |

Origin was also used to produce the figures for the INS, Raman and DRIFTS and activity plots.

**Raman data**

The Raman data can be found in the excel file named ‘Raman data’

**FITR data**

The DRIFTS data can be found in the excel file named ‘DRIFTS excel’

**INS data**

The INS data can be found at the ISIS Neutron and Muon Source Data Journal by following these links

<https://data.isis.stfc.ac.uk/doi/STUDY/103200776/>

<https://data.isis.stfc.ac.uk/doi/STUDY/103195237/>

**MS data**

The MS data used for Figure 1 is shown in the excel file ‘MS data’, Origin was used to produce the figure for the publication.