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INFLAME

Update November 2013
- Secondment to NIES, Japan

Cassie Rauert

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Update

- Last 6 month: completed 2 secondments
- #1: 2 weeks to IVL, Sweden
  - Developed model for chamber experiments (Giannis and Anna)
- #2: 2 months to NIES, Japan
  - Microscopy techniques on chamber samples and archived Birmingham dust

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Birmingham dust study

- Three UK archived dusts chosen for analysis
  - Contain very high levels of either BDE-209 or HBCDs

	ΣHBCDs (mg/g)	**BDE-209 (mg/g)**
House Dust 1	0.004	1.4
House Dust 2	0.001	0.3
Primary School Dust 3	0.9	0.2
Average UK House Dust	*0.003*	*0.01*

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Instruments used at NIES

- μEDX (Energy dispersive Micro X-ray fluorescence spectroscopy)
- Laser Microscopy
- SEM/EDS (Scanning electron microscopy with energy dispersive X-ray spectroscopy)
- FT-IR (Fourier Transform Infrared spectroscopy)

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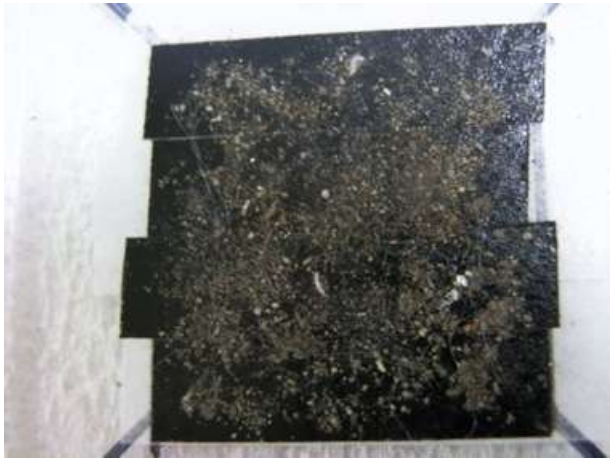
Preparation of Samples



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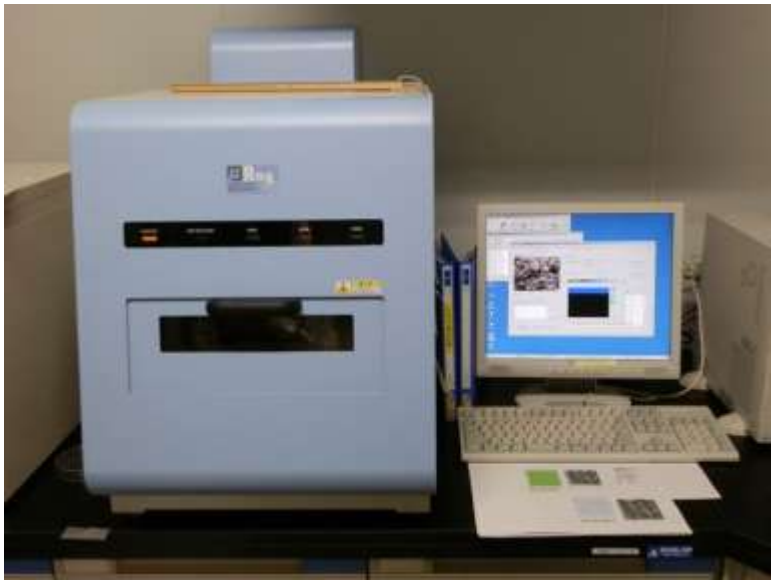
µEDX (Energy dispersive Micro X-ray fluorescence spectroscopy)

- µEDX
  - Mapping the sample identifies areas of high Br concentration (≥ 0.1%)



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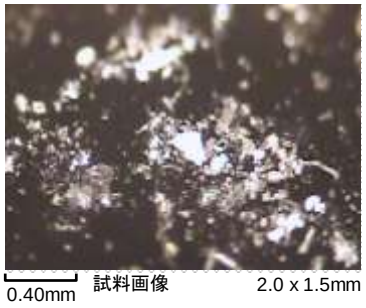
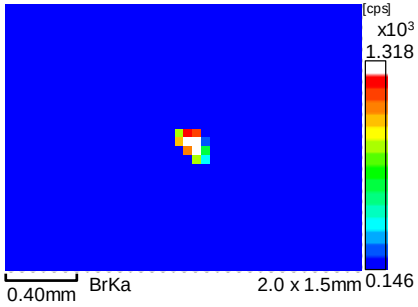
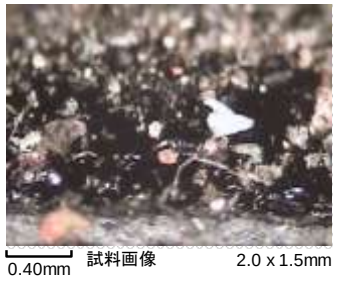
Birmingham dust study

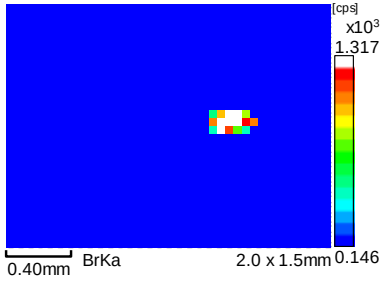
- 1 mg of dust mapped with μEDX to identify areas of high Br concentration
  - Triplicate analyses of all 3 dusts
- Bromine rich fragments located in all three dust samples
  - Dust 1: ~10 Br rich fragments in 1 mg sample
  - Dust 2: 6-12 Br rich fragments
  - Dust 3: 1-5 Br rich fragments

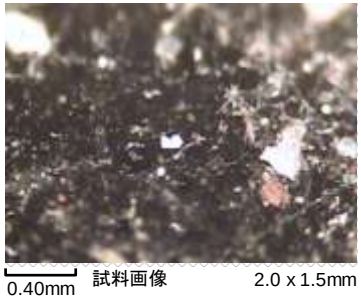
μEDX Bromine mapping

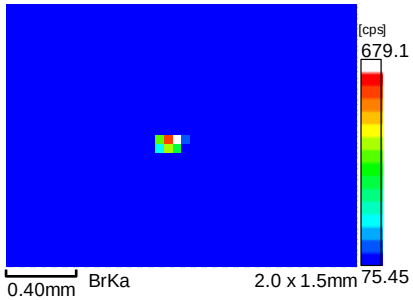


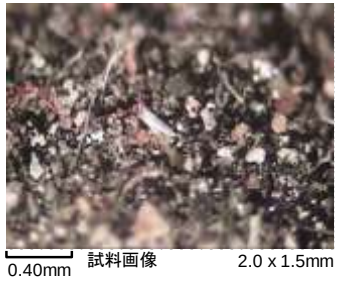


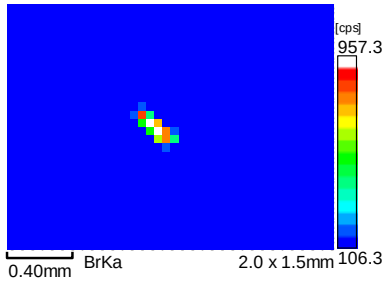


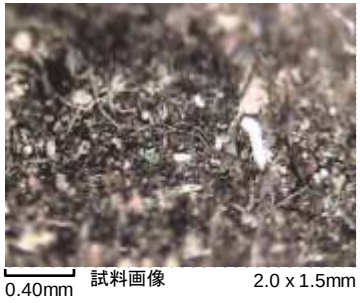


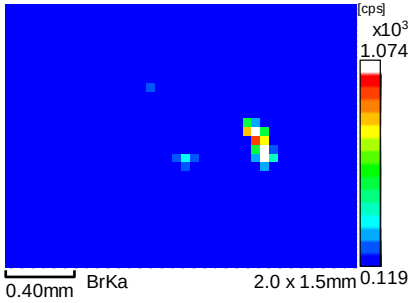












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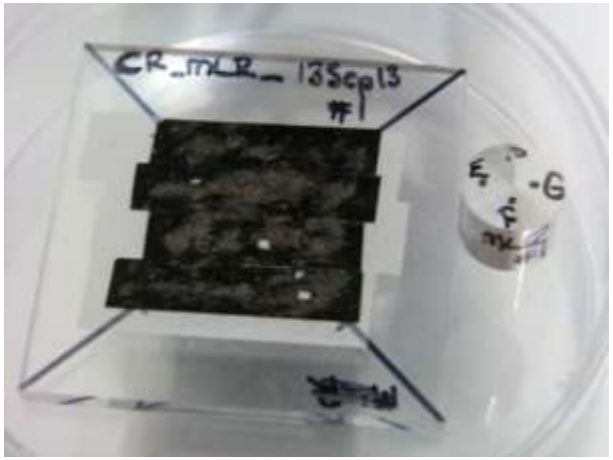
Separation of areas of interest



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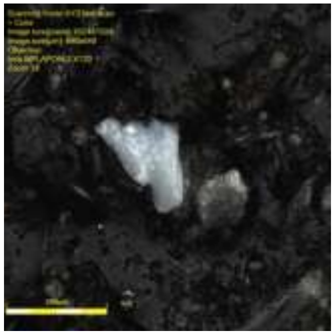
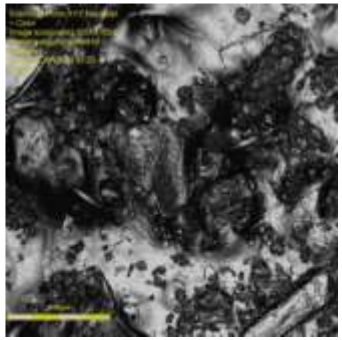
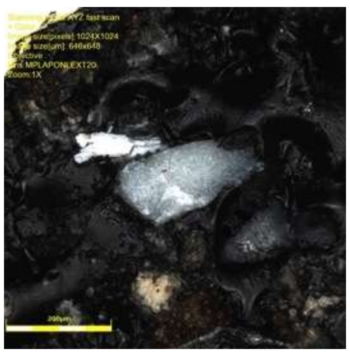
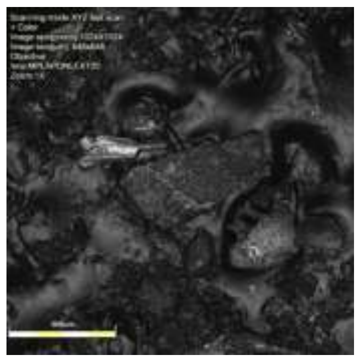
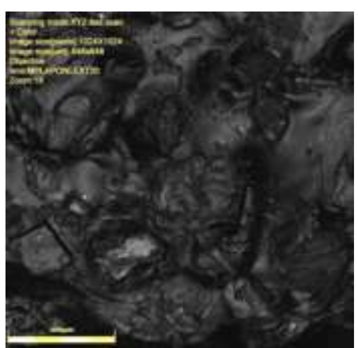
Laser Microscopy

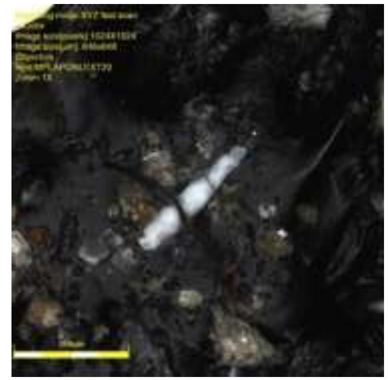


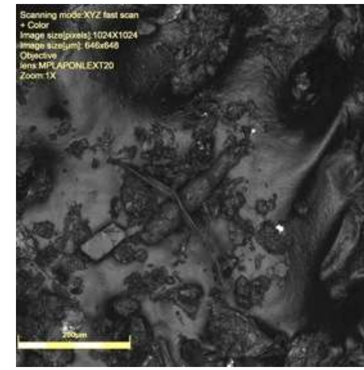


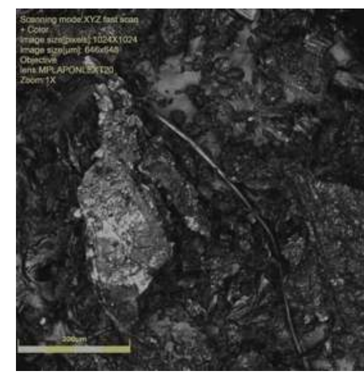












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SEM/EDS (Scanning Electron Microscopy with energy dispersive X-ray spectroscopy)

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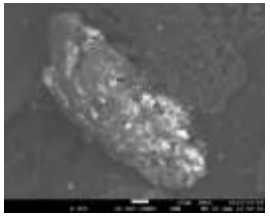
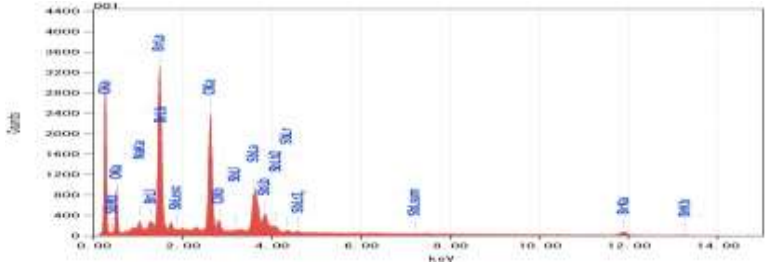
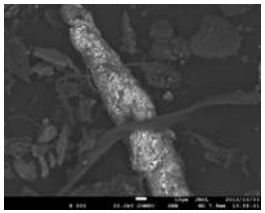
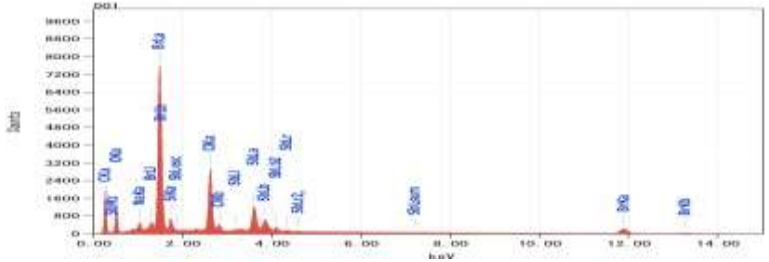
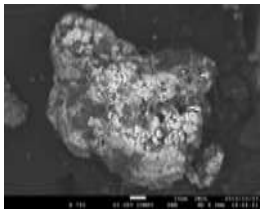
SEM/EDS of ‘suspect’ particles

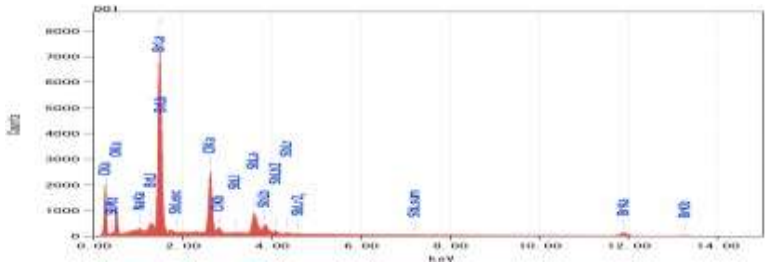


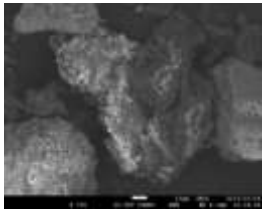


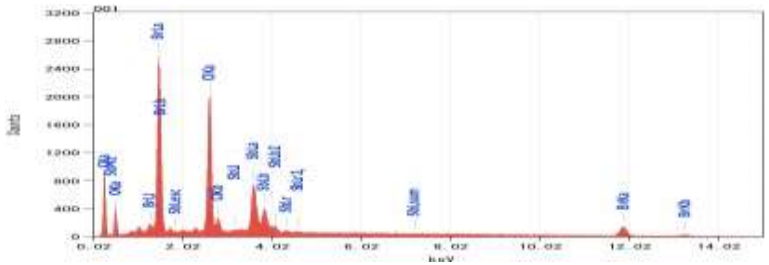












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FT-IR (Fourier transform Infra Red spectroscopy)

- % Transmission point analysis and sample mapping analysis
  - Provides information on particle/fibre composition

Diamond Cell

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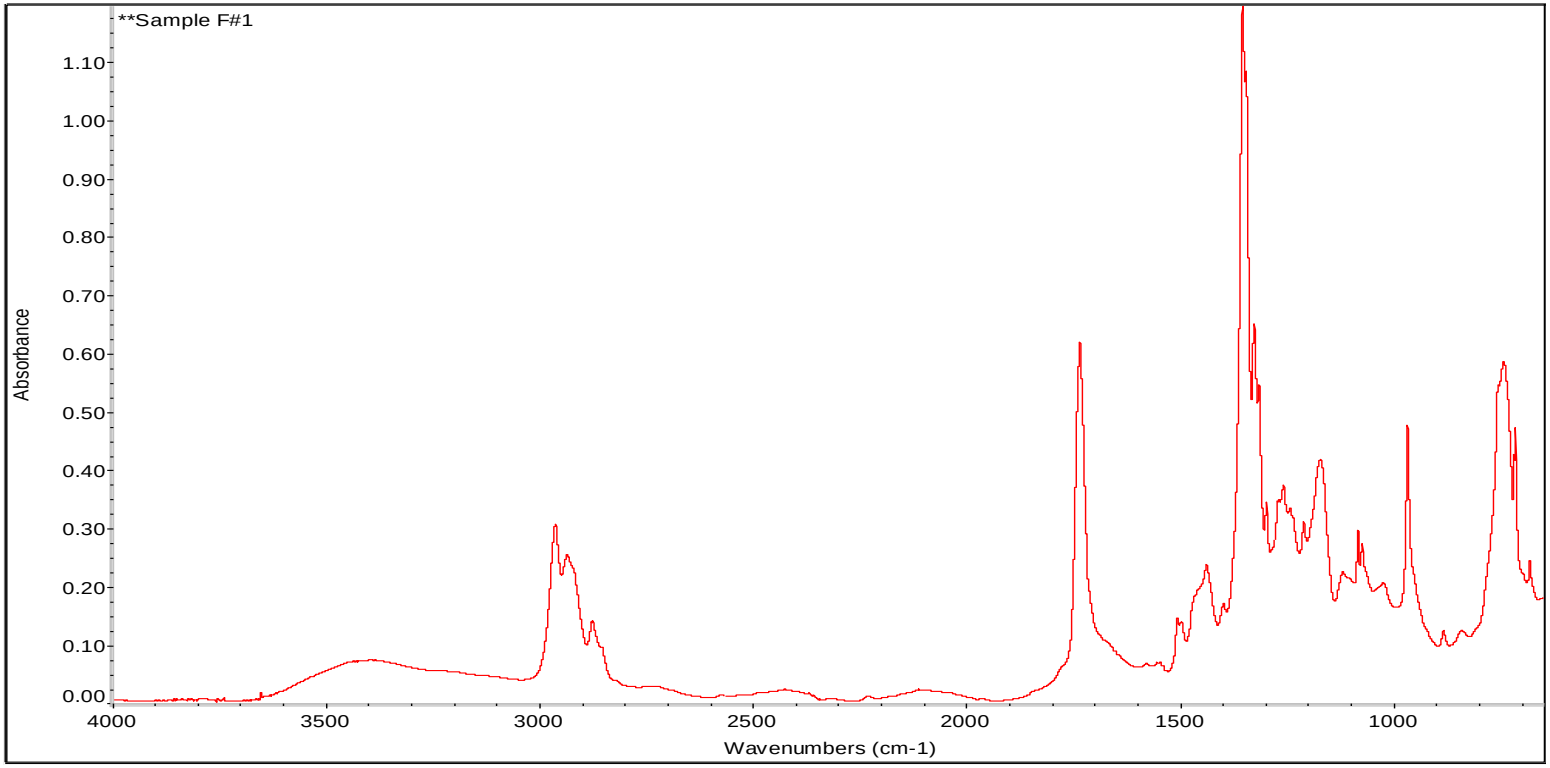
FT-IR

- House Dust 1 and 2 analysed further with FT-IR
  - From spectra try to determine composition of particle
- Particles in House Dust 3 too small for removal (~30μm)

House Dust 1 (1.4 mg/g BDE-209)



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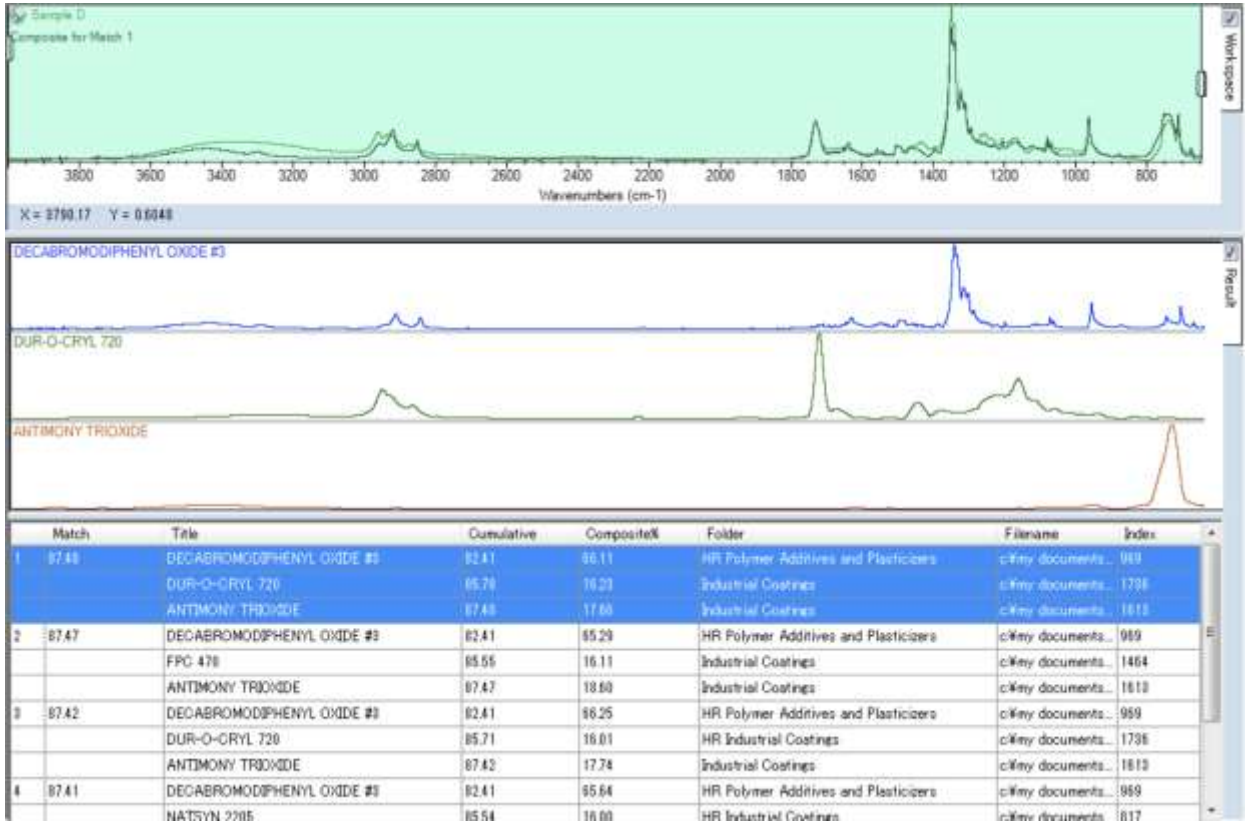
House Dust 1 (1.4 mg/g BDE-209)



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		ANTIMONY TRIOXIDE	87.48	17.66	Industrial Coatings	c:\my documents...	1813
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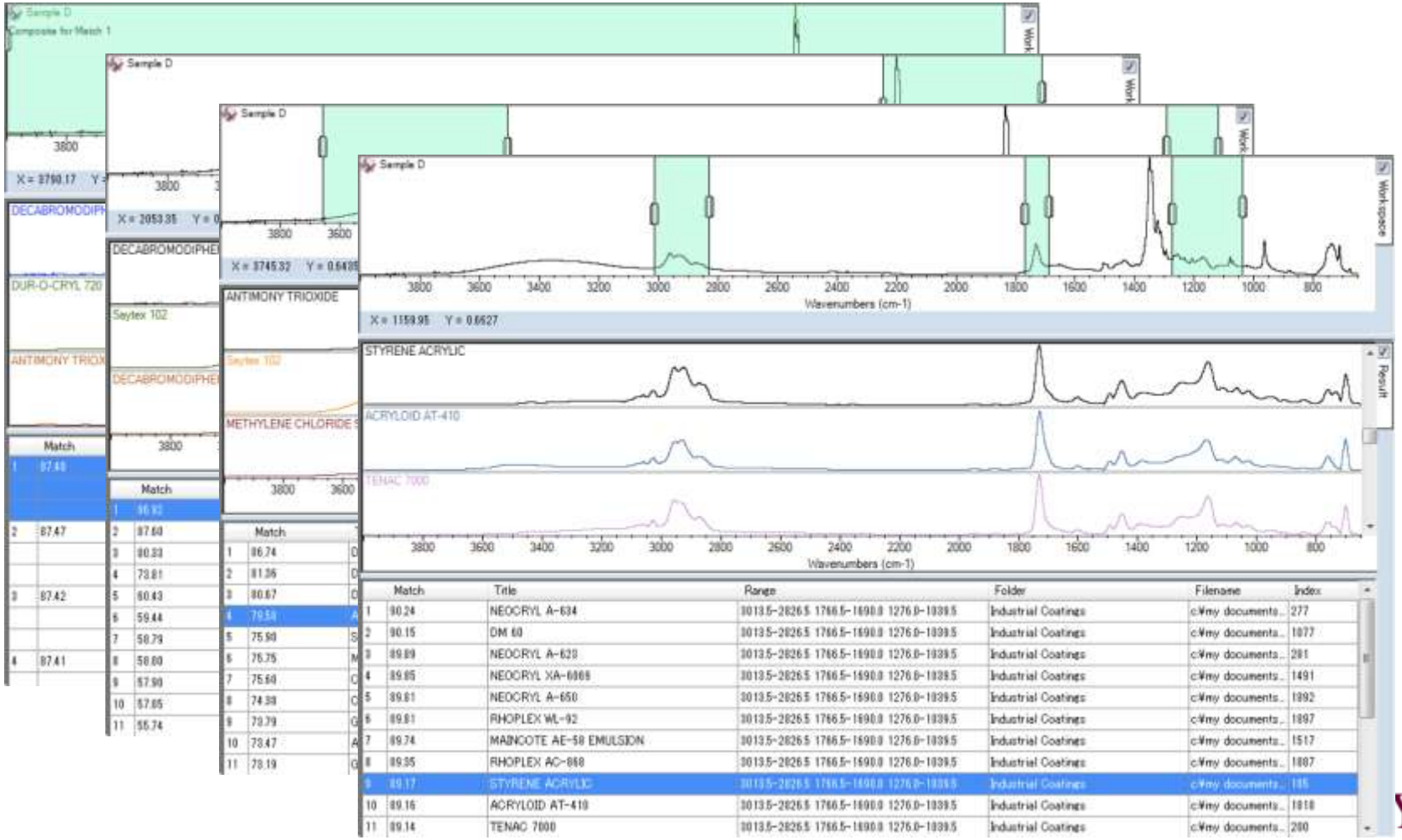
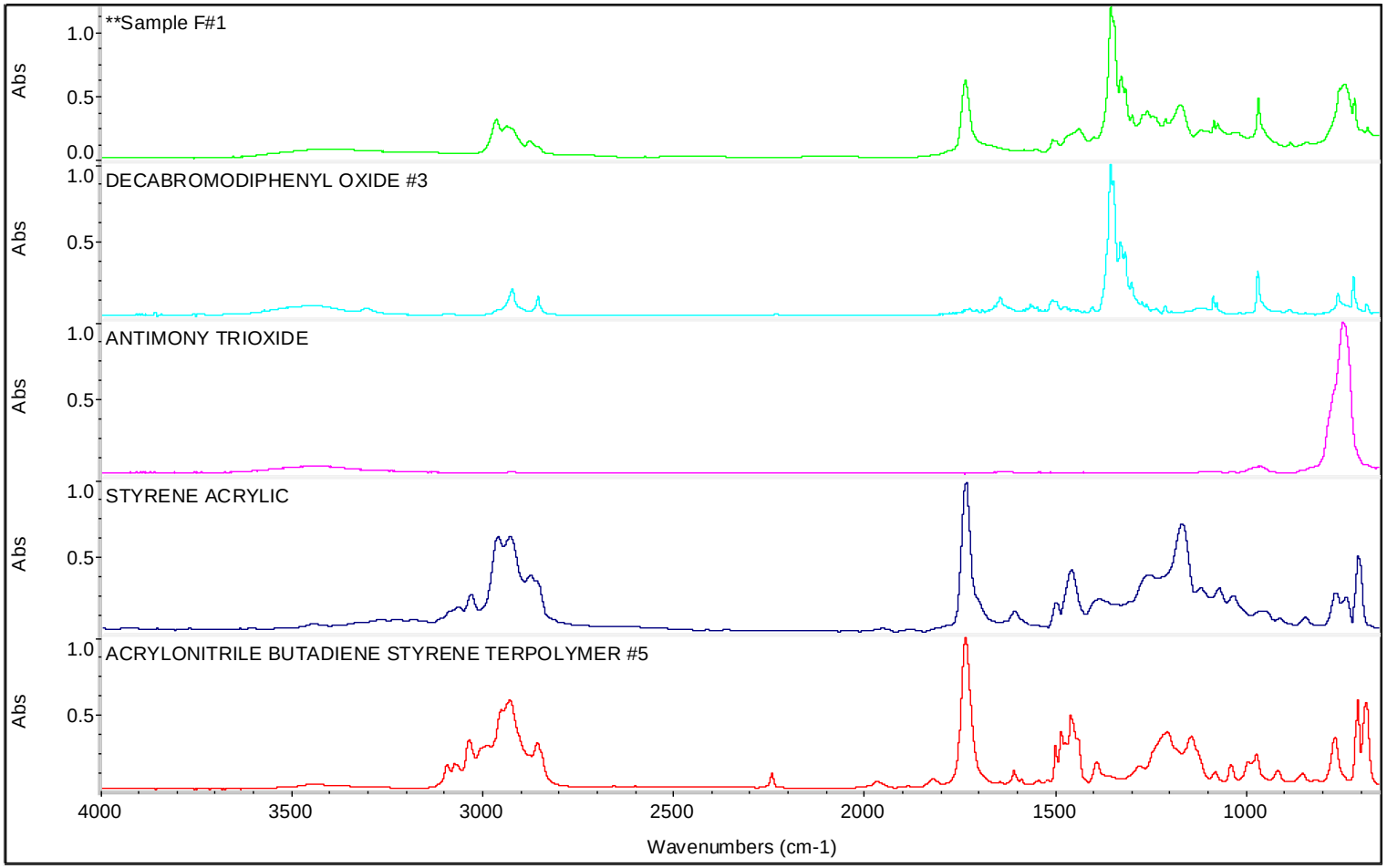
House Dust 1 (1.4 mg/g BDE-209)



House Dust 1 (1.4 mg/g BDE-209)



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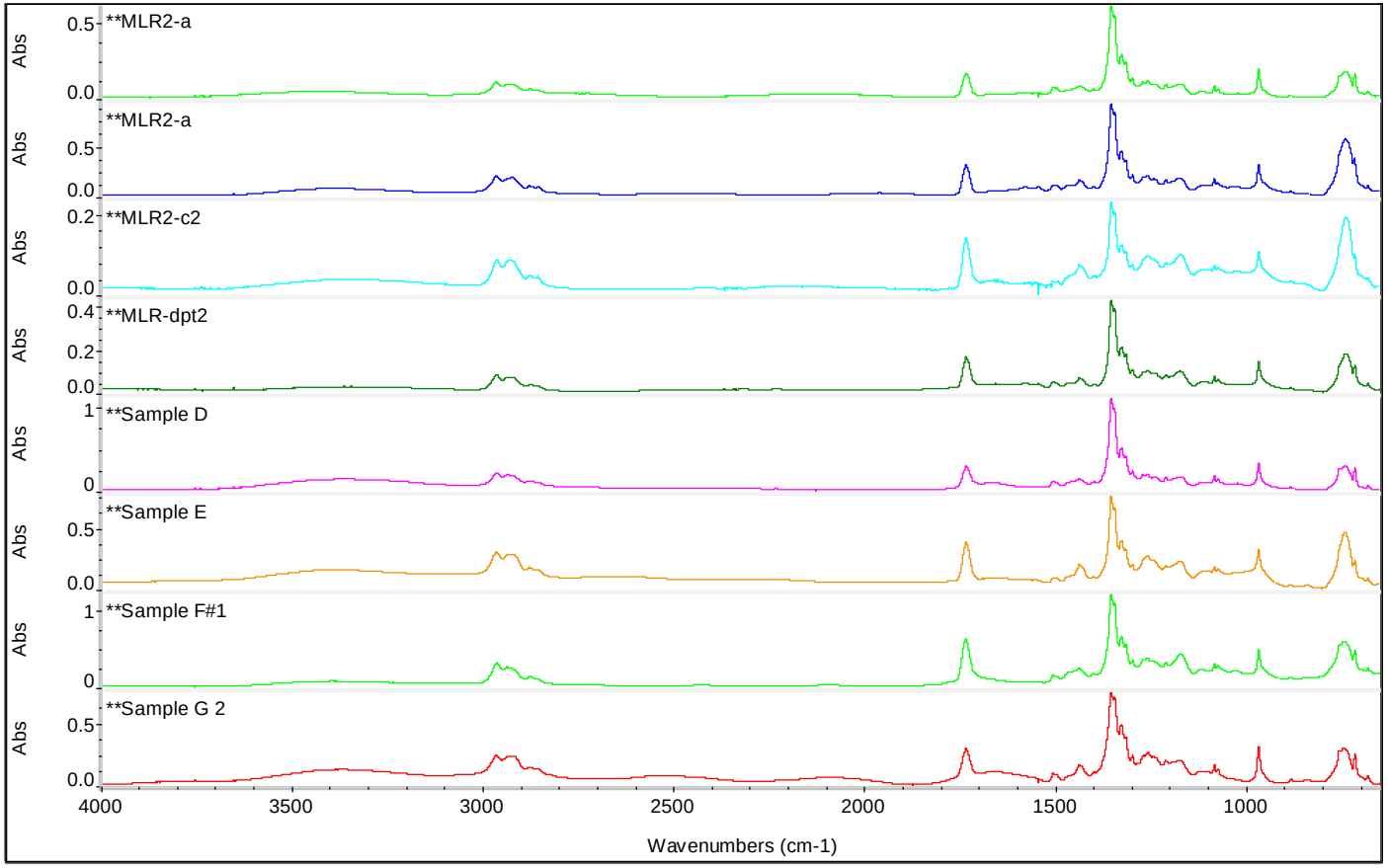
House Dust 1 (1.4 mg/g BDE-209)



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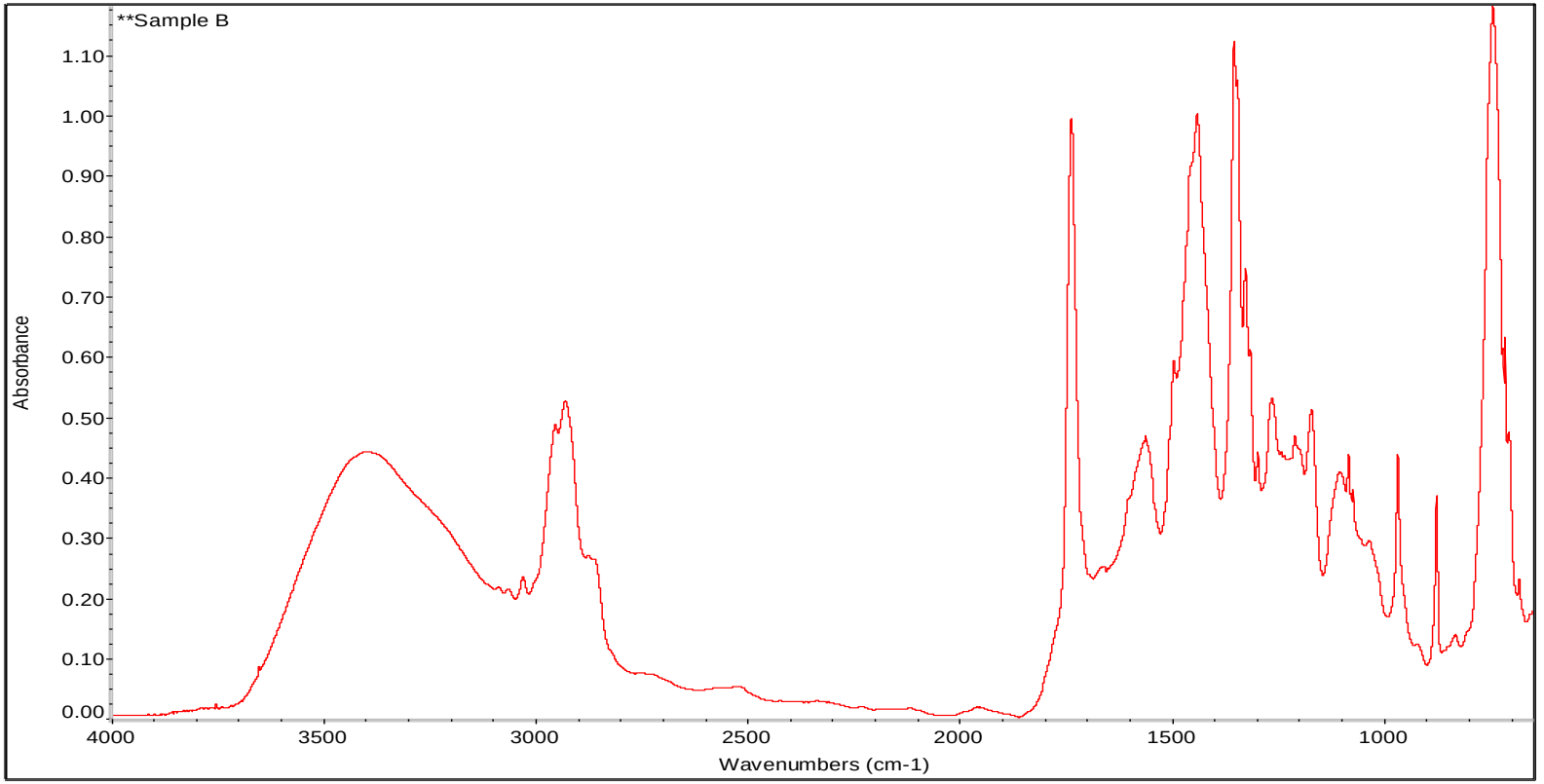
House Dust 2 (0.3 mg/g BDE-209)



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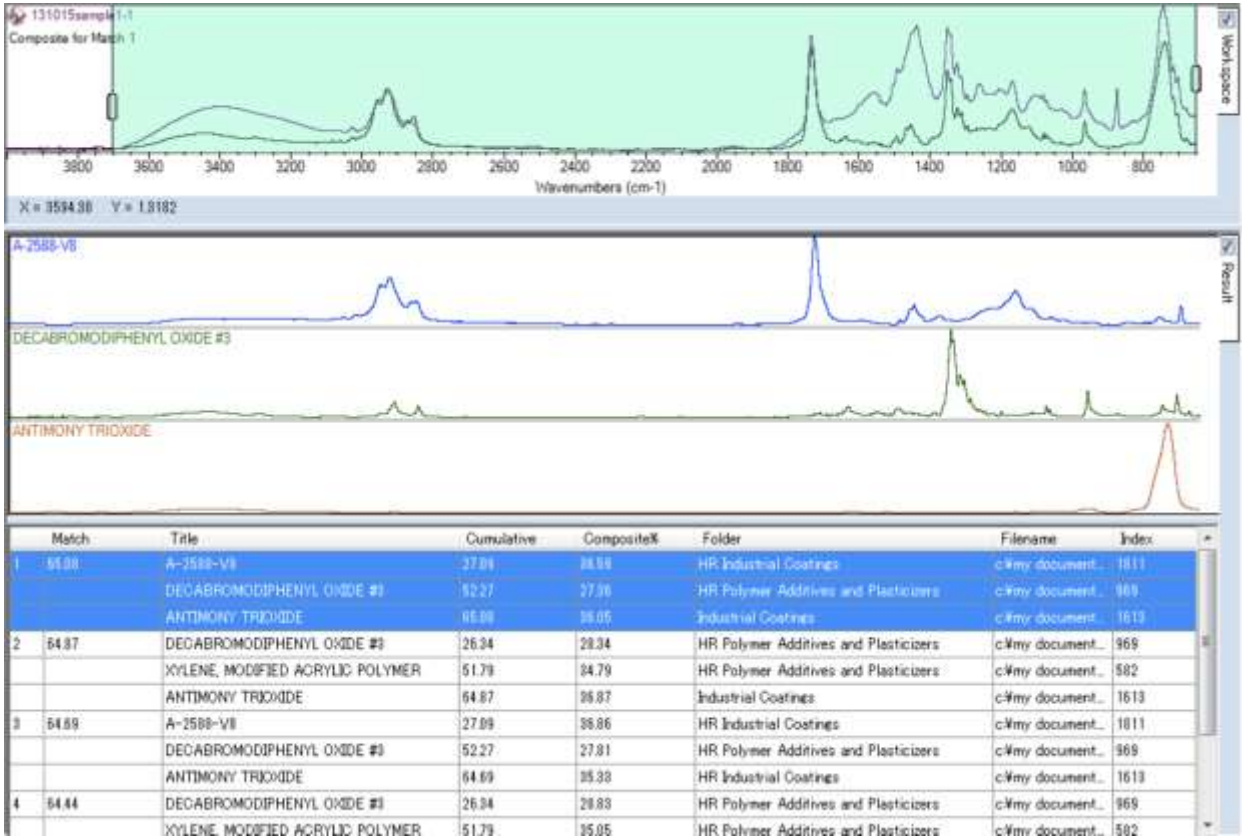
House Dust 2 (0.3 mg/g BDE-209)



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		ANTIMONY TRIOXIDE	65.88	38.05	Industrial Coatings	c:¥my document...	1613
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		XYLENE, MODIFIED ACRYLIC POLYMER	51.79	34.79	HR Polymer Additives and Plasticizers	c:¥my document...	582
		ANTIMONY TRIOXIDE	64.87	36.87	Industrial Coatings	c:¥my document...	1613
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		ANTIMONY TRIOXIDE	64.69	35.33	HR Industrial Coatings	c:¥my document...	1613
4	64.44	DECABROMODIPHENYL OXIDE #3	26.34	28.83	HR Polymer Additives and Plasticizers	c:¥my document...	969
		XYLENE, MODIFIED ACRYLIC POLYMER	51.79	35.05	HR Polymer Additives and Plasticizers	c:¥my document...	582

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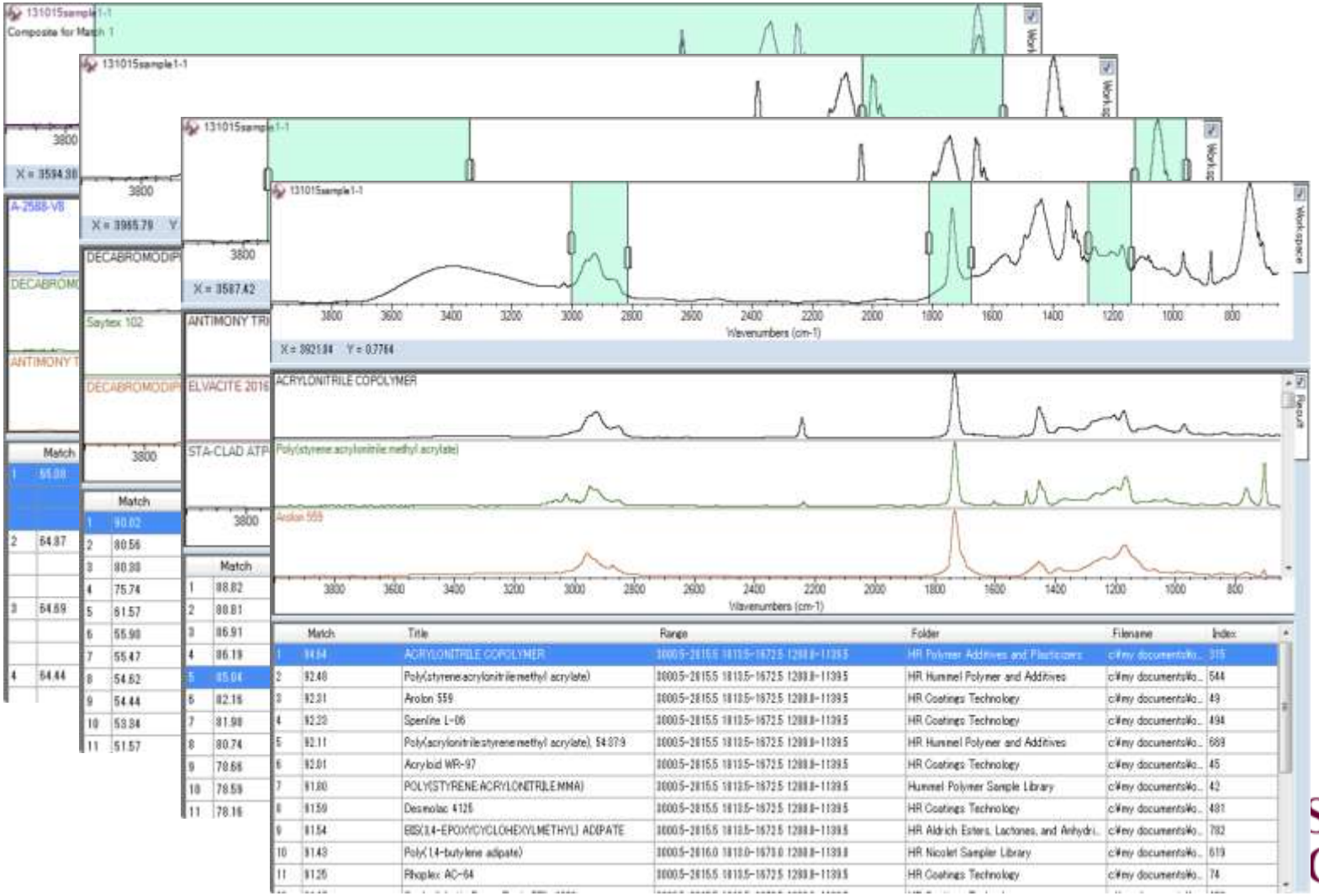
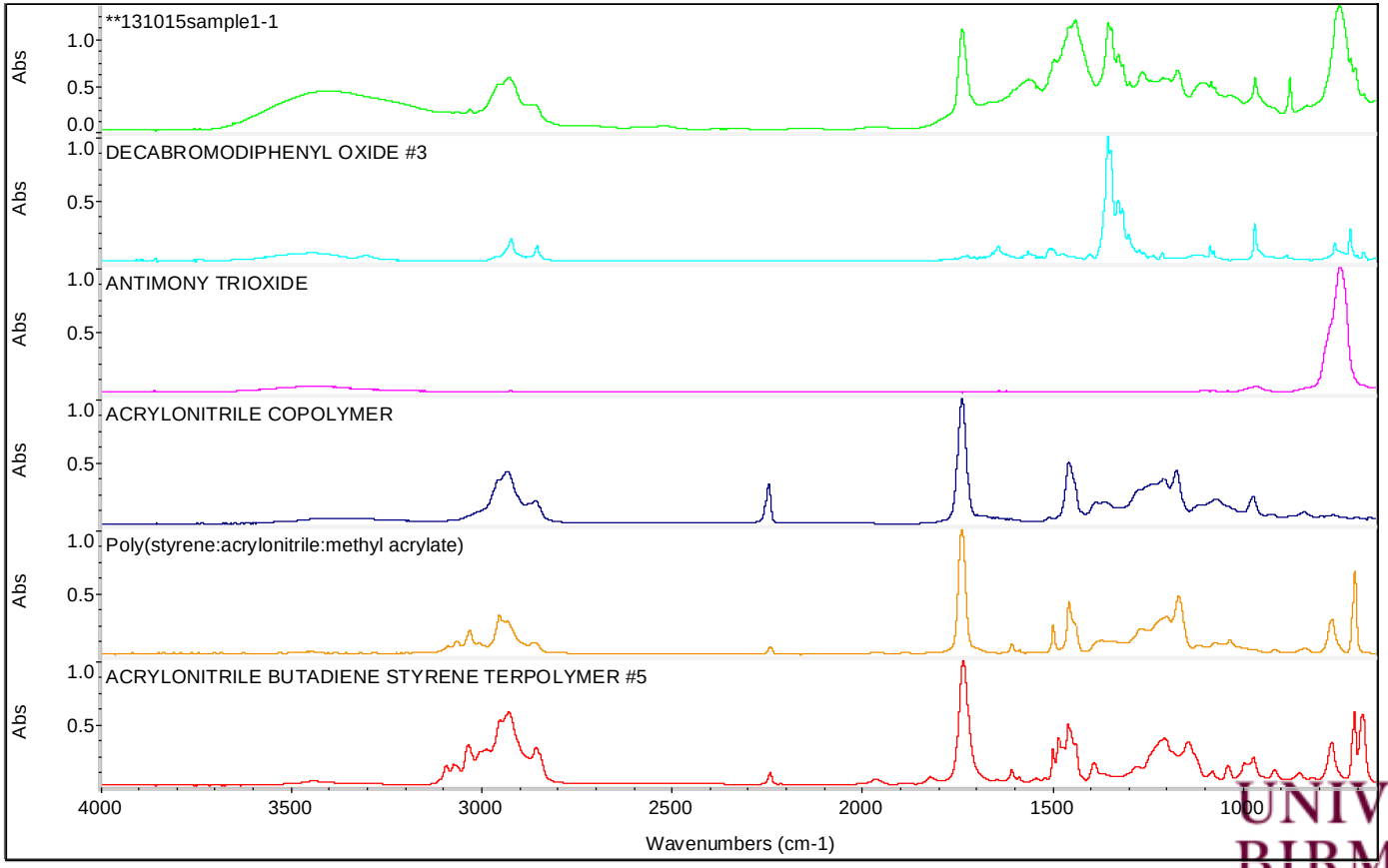
House Dust 2 (0.3 mg/g BDE-209)



House Dust 2 (0.3 mg/g BDE-209)

Possibly ABS plastic again??



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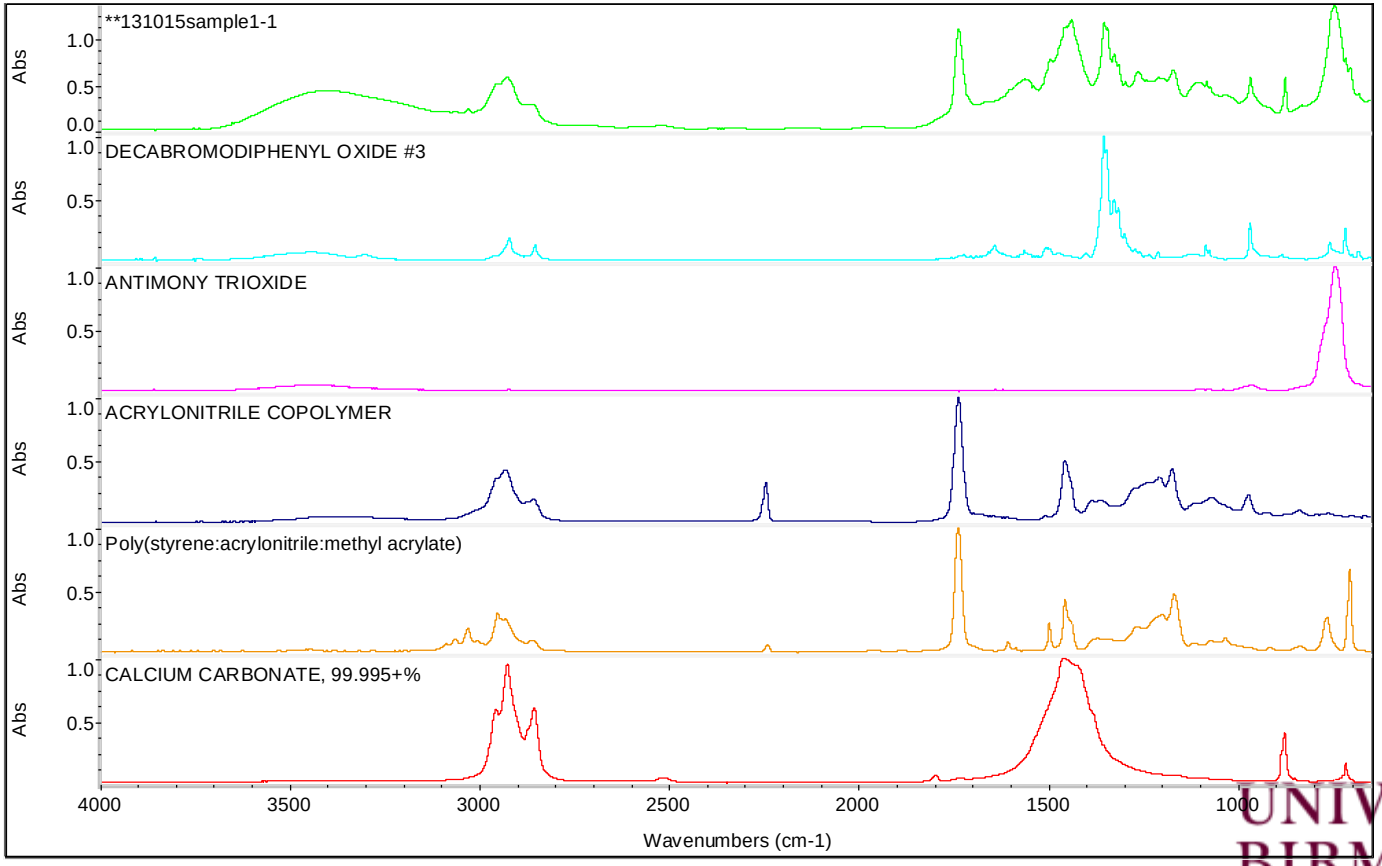
House Dust 2 (0.3 mg/g BDE-209)

$CaCO_3$ present in resin



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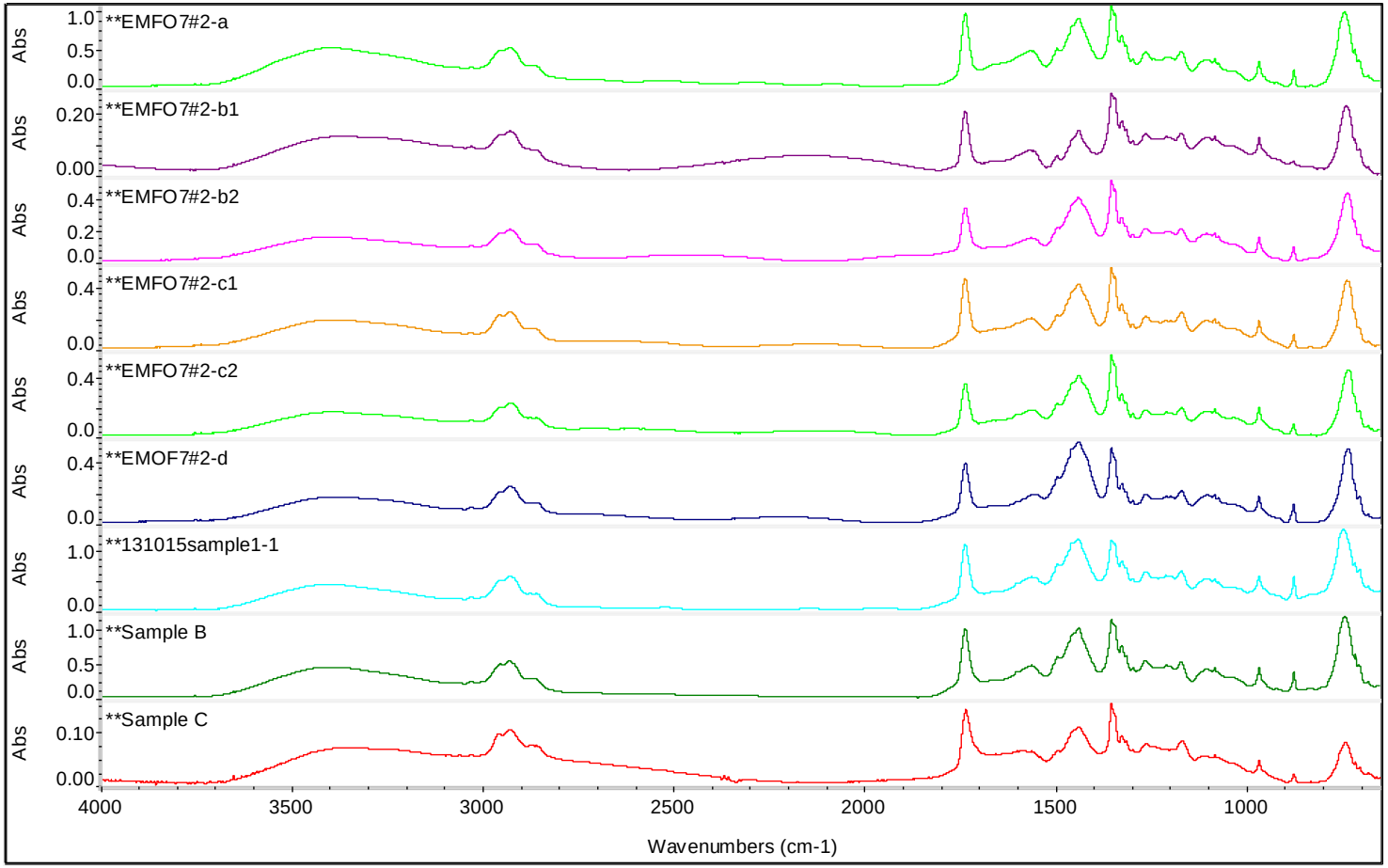
House Dust 2 (0.3 mg/g BDE-209)



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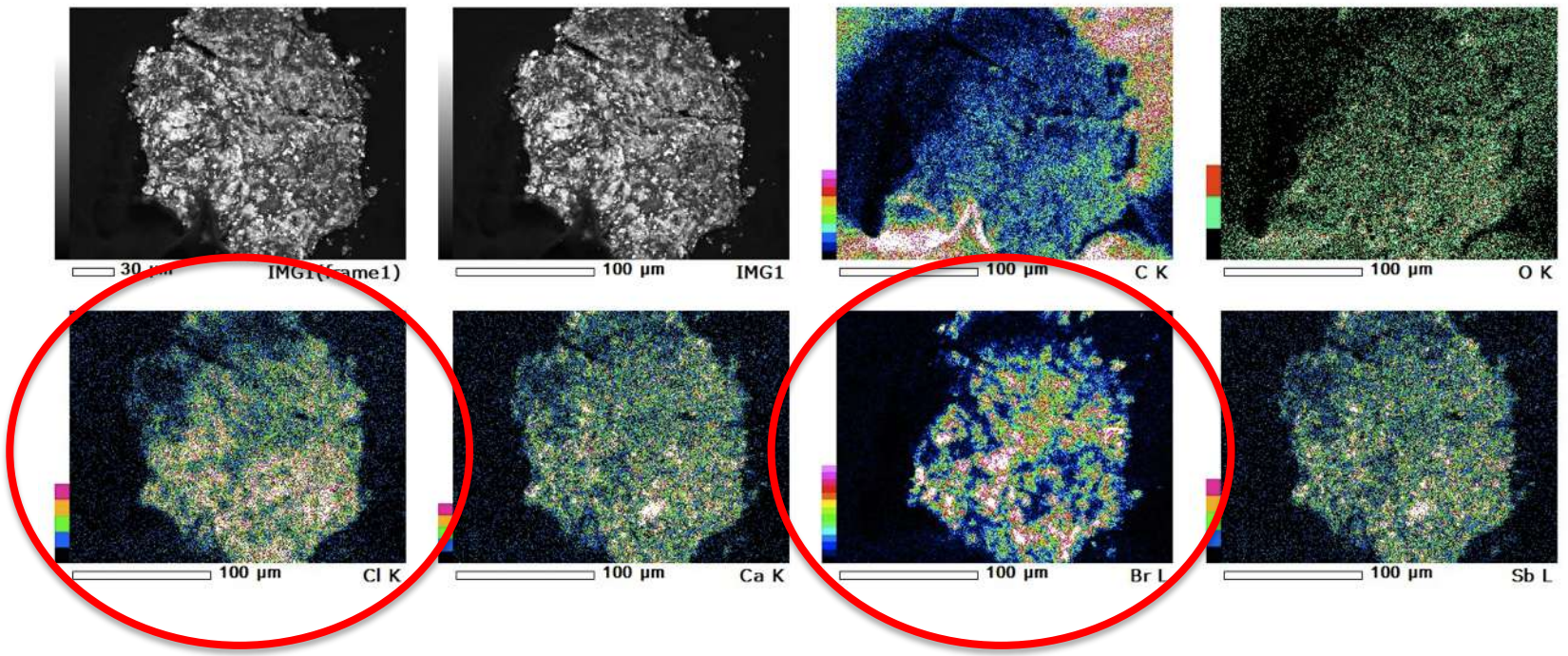
Return to SEM/EDS



SEM mapping shows distinct areas in particle containing Br and also Cl

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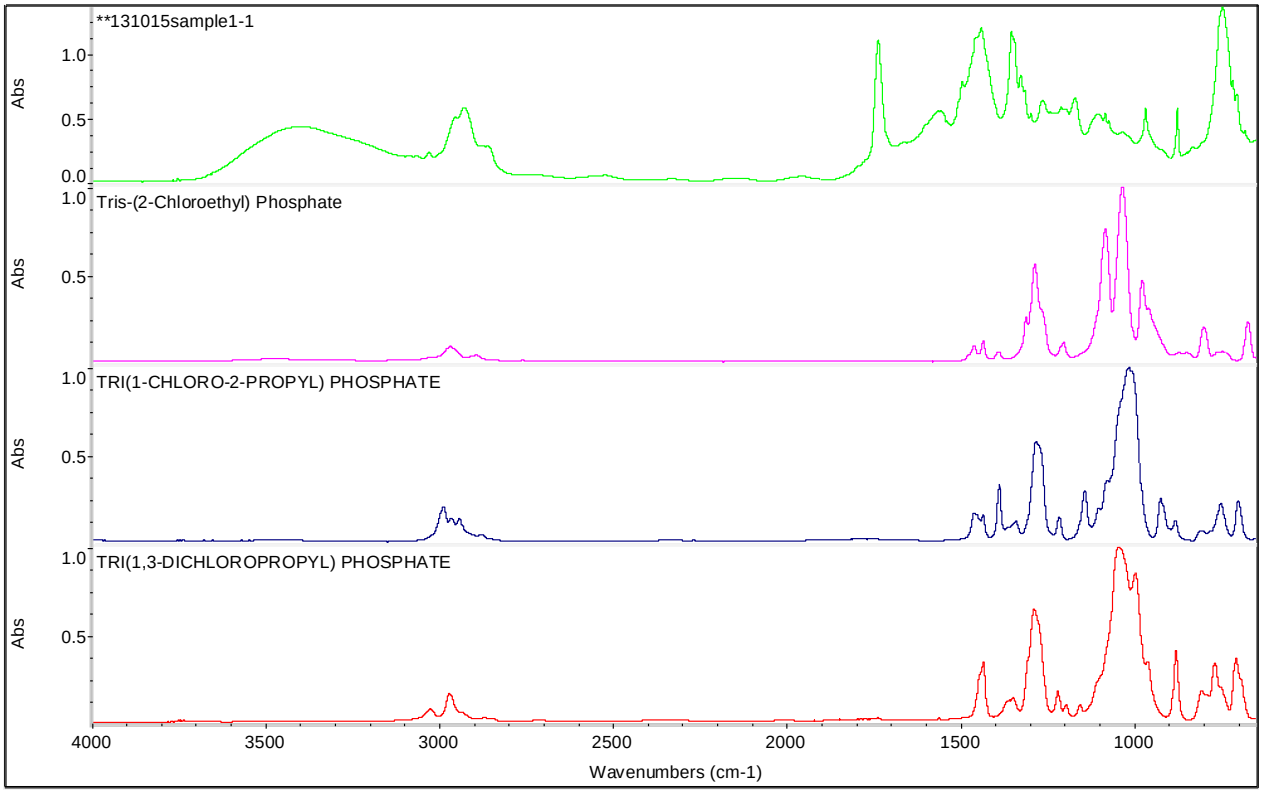
Cl containing PFRs not identified with FT-IR

- Not the source of the Cl (something else is)
- OR: Concentration too low for FT-IR to pick up



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Conclusions

- Able to show all dusts were contaminated by the abrasion migration pathway
- Same methods used for chamber abrasion samples to analyse produced fibres
  - Concentration in volatilization samples too low

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Next

- Particles isolated from Dusts #1 and #2 for quantitative analysis at UoB.
  - Determine BDE-209 concentration

- *Questions/Comments???*

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