APPENDIX 59: SCANNING ELECTRON MICROSCOPY OF GLASS PRODUCTION RESIDUE SAMPLES

This appendix summarises the results of the scanning electron microscopic (SEM) examination of selected mounted sub-samples, subsequent to their optical microscopy and following the laboratory measurement of mass specific magnetic susceptibility of a series of samples obtained from the following locations:

Hutton Common, N. Yorkshire

Knightons, Surrey

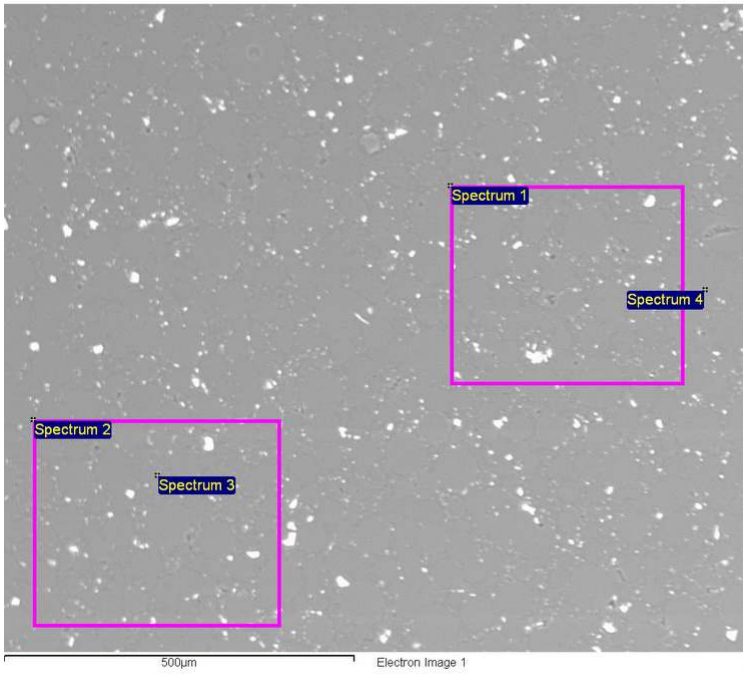
St. Aidan's, W. Yorkshire

The sub-samples were selected on the basis of the minimum, mean and maximum values in the measured range of magnetic susceptibility for each sample group; thus each site is represented by a set of three data sheets. These sheets are arranged in site order as listed above, and minimum, mean and maximum susceptibility within each site data.

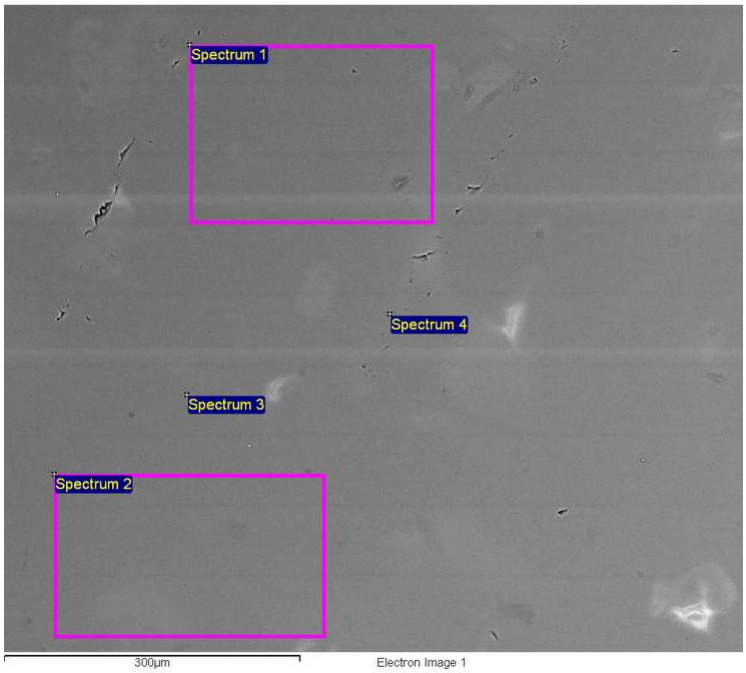
Each data set consists of the sites of interest chosen for SEM analysis and the spectra analyses for those sites; the images are annotated with the analysis locations.

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Hutton Common waste H4E



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common waste H4E** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	2.2	2.9	3.0	2.9	3.0	3.9	n.d.			n.d.		
Mg	MgO	n.d.			n.d.			0.4	1.3	0.7	3.4	10.9	5.7
Al	Al2O3	1.0	1.4	1.9	0.3	1.5	0.6	1.0	1.0	2.0	0.4	8.3	0.7
Si	SiO2	n.d.			0.2	1.4	0.5	0.6	0.9	1.3	8.7	8.3	18.7
P	P2O5	n.d.			0.9	1.4	2.0	n.d.			10.6	9.2	24.4
S	SO3	1.6	1.1	4.0	0.2	1.2	0.5	1.0	0.9	2.4	3.3	7.2	8.4
Cl		1.8	1.2	0.0	0.2	1.2	0.0	1.5	0.9	0.0	7.6	7.7	0.0
K	K2O	0.4	0.9	0.4	0.1	1.0	0.2	0.6	0.7	0.7	5.0	6.5	6.0
Ca	CaO	65.3	7.0	91.3	66.4	7.2	92.9	62.4	4.6	87.3	32.3	18.3	45.1
Ti	TiO2	n.d.			0.8	1.6	1.3	n.d.			2.0	8.1	3.4
V	V2O5	0.1	1.8	0.2	n.d.			n.d.			n.d.		
Cr	Cr2O3	0.9	1.4	1.3	n.d.			n.d.			n.d.		
Mn	MnO	n.d.			n.d.			1.3	1.1	1.7	n.d.		
Fe	Fe2O3	0.9	1.9	1.4	2.0	1.9	2.9	1.4	1.2	1.9	n.d.		
Co	CoO	1.7	2.3	2.2	2.0	2.3	2.6	1.3	1.5	1.7	n.d.		
Ni	NiO	n.d.			n.d.			2.0	1.7	2.5	n.d.		
Cu	CuO	4.0	3.4	5.0	2.4	3.4	3.1	1.4	2.2	1.8	10.3	15.2	12.9
Zn	ZnO	n.d.			n.d.			0.7	2.9	0.9	5.0	19.6	6.3
O		28.4	4.9		28.9	5.0		28.6	3.4		40.6	26.0	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 2
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
No optimization has been performed.
Detector efficiency : Calculation

H4E: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common waste H4E** **Site of Interest 2**

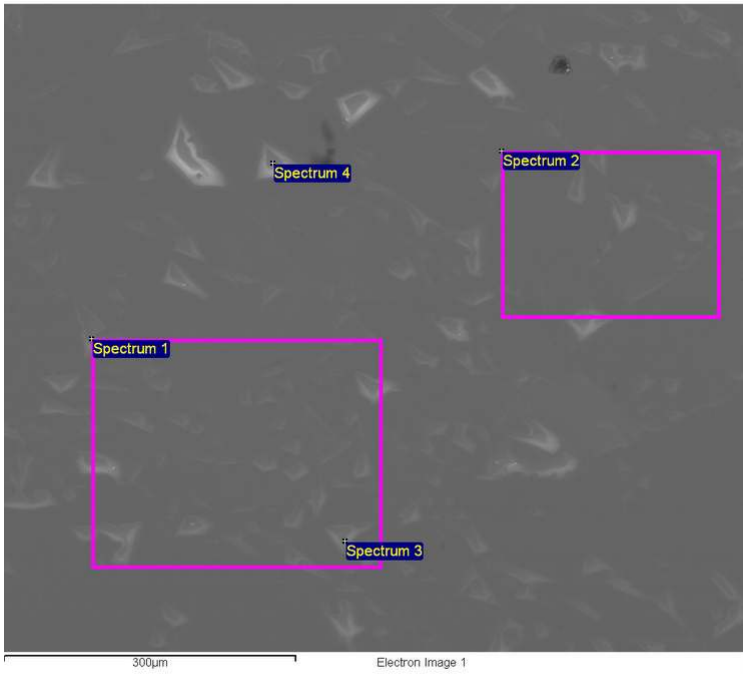
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.6	0.1	2.1	1.5	0.1	2.0	1.5	0.1	2.0	1.5	0.1	2.02
Mg	MgO	1.3	0.0	2.2	1.3	0.0	2.2	1.3	0.0	2.2	1.4	0.0	2.24
Al	Al2O3	1.2	0.0	2.2	1.2	0.0	2.3	1.2	0.0	2.3	1.2	0.0	2.31
Si	SiO2	31.3	0.1	66.9	31.3	0.1	67.0	31.4	0.1	67.2	31.4	0.1	67.11
P	P2O5	0.8	0.0	1.8	0.8	0.0	1.7	0.8	0.0	1.7	0.8	0.0	1.78
S	SO3	0.1	0.0	0.2	0.1	0.0	0.2	0.1	0.0	0.2	0.1	0.0	0.19
Cl		0.8	0.0	0.0	0.8	0.0	0.0	0.8	0.0	0.0	0.8	0.0	0.0
K	K2O	2.7	0.0	3.3	2.7	0.0	3.3	2.7	0.0	3.3	2.7	0.0	3.25
Ca	CaO	13.6	0.1	19.0	13.6	0.1	19.0	13.6	0.1	19.1	13.5	0.1	18.83
Ti	TiO2	0.1	0.0	0.2	0.2	0.0	0.3	0.1	0.0	0.2	0.2	0.0	0.25
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.11
Mn	MnO	0.3	0.0	0.3	0.2	0.0	0.3	0.2	0.0	0.3	0.2	0.0	0.28
Fe	Fe2O3	0.6	0.0	0.8	0.5	0.0	0.7	0.6	0.0	0.8	0.5	0.0	0.71
Co	CoO	n.d.			n.d.			n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Zn	ZnO	0.1	0.1	0.1	n.d.			n.d.			0.1	0.1	0.06
O		45.6	0.1		45.7	0.1		45.7	0.1		45.7	0.1	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
No optimization has been performed.
Detector efficiency : Calculation

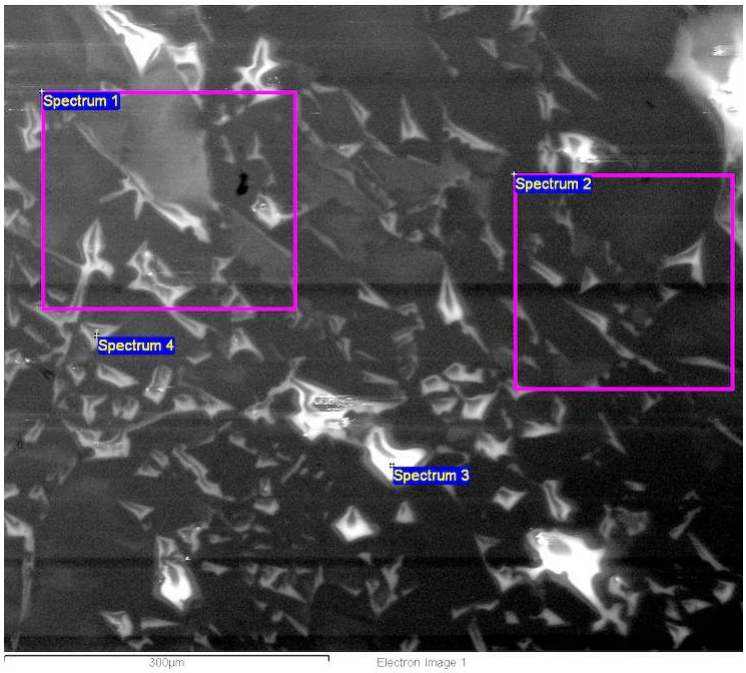
H4E: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Hutton Common waste H4G



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common waste H4G** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.5	0.1	2.0	1.4	0.1	1.9	1.4	0.1	1.9	1.5	0.1	2.1
Mg	MgO	1.4	0.1	2.4	1.5	0.0	2.4	1.6	0.1	2.6	1.4	0.1	2.4
Al	Al2O3	1.6	0.1	3.1	1.6	0.0	3.0	1.6	0.1	3.0	1.7	0.1	3.2
Si	SiO2	29.5	0.2	63.0	29.4	0.1	62.9	29.7	0.2	63.6	29.6	0.1	63.3
P	P2O5	0.9	0.1	2.1	0.9	0.0	2.2	0.9	0.1	2.2	0.9	0.1	2.1
S	SO3	0.2	0.0	0.5	0.2	0.0	0.5	0.2	0.0	0.5	0.2	0.0	0.5
Cl		0.6	0.0	0.0	0.6	0.0	0.0	0.6	0.1	0.0	0.5	0.0	0.0
K	K2O	4.2	0.1	5.0	4.2	0.1	5.1	4.1	0.1	5.0	4.2	0.1	5.1
Ca	CaO	13.8	0.1	19.3	13.8	0.1	19.4	13.7	0.1	19.2	13.6	0.1	19.1
Ti	TiO2	0.2	0.1	0.3	0.2	0.0	0.3	0.2	0.1	0.3	0.2	0.0	0.4
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			0.1	0.0	0.2	n.d.			n.d.		
Mn	MnO	0.2	0.1	0.3	0.2	0.0	0.3	0.2	0.1	0.3	0.2	0.1	0.2
Fe	Fe2O3	1.1	0.1	1.6	1.0	0.1	1.4	0.9	0.1	1.3	1.0	0.1	1.4
Co	CoO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.			0.1	0.1	0.1
Zn	ZnO	0.1	0.1	0.1	n.d.			n.d.			n.d.		
O		44.9	0.2		44.9	0.1		45.1	0.2		45.0	0.2	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
No optimization has been performed.
Detector efficiency : Calculation

H4G: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common waste H4G** **Site of Interest 2**

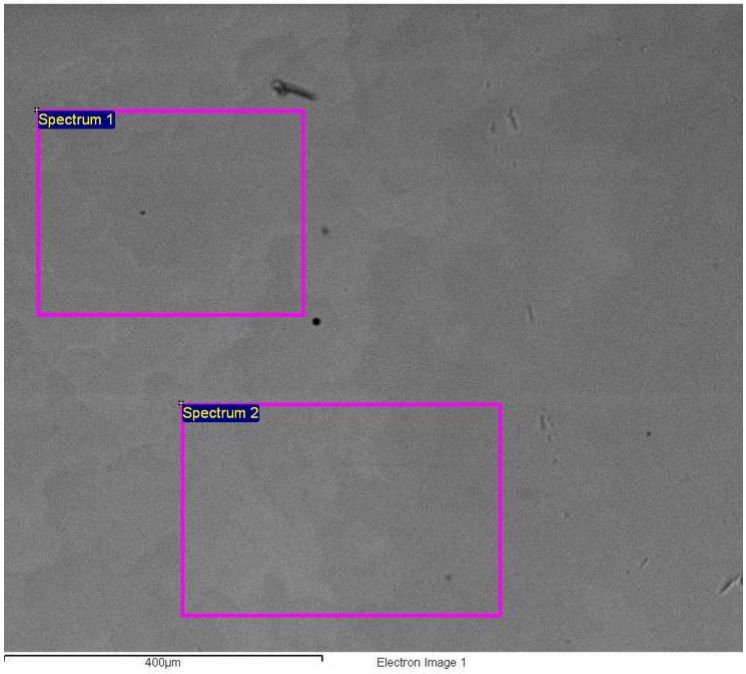
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.5	0.1	2.1	1.5	0.1	2.0	1.6	0.1	2.2	1.5	0.1	2.0
Mg	MgO	1.5	0.0	2.6	1.5	0.0	2.5	1.6	0.0	2.6	1.5	0.0	2.5
Al	Al2O3	1.7	0.0	3.1	1.6	0.0	3.1	1.7	0.0	3.2	1.7	0.0	3.2
Si	SiO2	29.7	0.1	63.4	29.5	0.1	63.1	29.7	0.1	63.6	29.5	0.1	63.1
P	P2O5	1.0	0.0	2.3	0.9	0.0	2.2	1.0	0.0	2.2	1.0	0.0	2.2
S	SO3	0.2	0.0	0.5	0.2	0.0	0.5	0.3	0.0	0.6	0.2	0.0	0.5
Cl		0.6	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0
K	K2O	4.1	0.1	4.9	4.3	0.1	5.2	4.1	0.1	4.9	4.2	0.1	5.0
Ca	CaO	13.2	0.1	18.5	13.7	0.1	19.2	13.1	0.1	18.3	13.5	0.1	18.9
Ti	TiO2	0.2	0.0	0.3	0.1	0.0	0.2	0.2	0.0	0.3	0.2	0.0	0.3
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			n.d.			n.d.			n.d.		
Mn	MnO	0.2	0.0	0.3	0.2	0.0	0.3	0.2	0.0	0.2	0.2	0.0	0.3
Fe	Fe2O3	0.9	0.1	1.2	0.9	0.1	1.3	0.9	0.1	1.2	0.9	0.1	1.3
Co	CoO	0.1	0.1	0.1	n.d.			0.1	0.1	0.1	n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.			n.d.		
Zn	ZnO	0.1	0.1	0.1	0.1	0.1	0.1	n.d.			0.1	0.1	0.1
O		45.1	0.1		44.9	0.1		45.2	0.1		45.0	0.1	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
No optimization has been performed.
Detector efficiency : Calculation

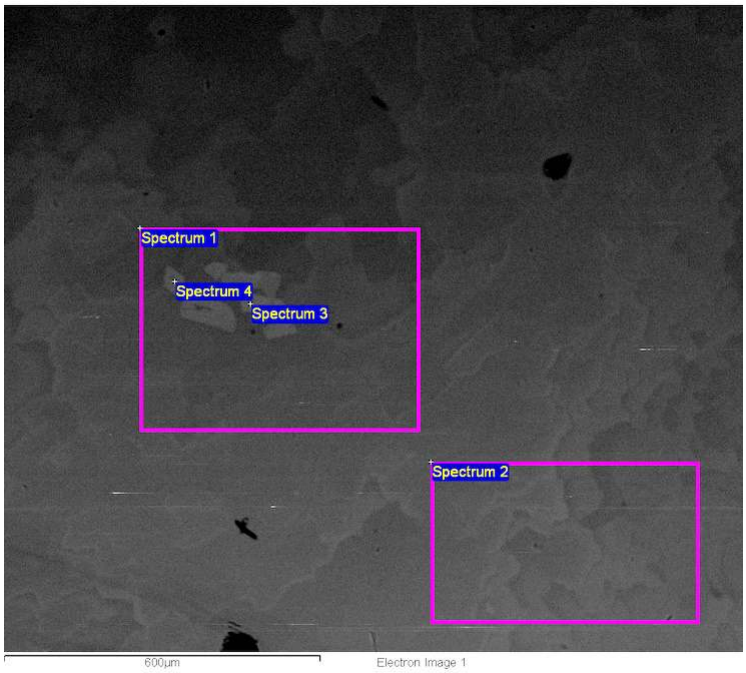
H4G: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Hutton Common slag H4A



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common slag H4A** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.1	0.1	1.4	1.2	0.1	1.6
Mg	MgO	2.2	0.1	3.7	2.2	0.1	3.6
Al	Al2O3	1.2	0.1	2.2	1.1	0.0	2.1
Si	SiO2	27.7	0.1	59.2	27.6	0.1	59.1
P	P2O5	1.5	0.1	3.3	1.4	0.1	3.2
S	SO3	0.1	0.0	0.4	0.1	0.0	0.1
Cl		0.6	0.0	0.0	0.6	0.0	0.0
K	K2O	8.2	0.1	9.9	8.1	0.1	9.8
Ca	CaO	12.8	0.1	17.9	13.0	0.1	18.1
Ti	TiO2	0.1	0.0	0.2	0.2	0.0	0.3
V	V2O5	n.d.			n.d.		
Cr	Cr2O3	n.d.			0.1	0.0	0.1
Mn	MnO	0.4	0.1	0.6	0.5	0.1	0.6
Fe	Fe2O3	0.5	0.1	0.7	0.6	0.1	0.8
Co	CoO	n.d.			n.d.		
Ni	NiO	n.d.			n.d.		
Cu	CuO	n.d.			0.1	0.1	0.1
Zn	ZnO	n.d.			n.d.		
O		43.7	0.2		43.5	0.2	
Totals		100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

H4A: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common slag H4A** **Site of Interest 2**

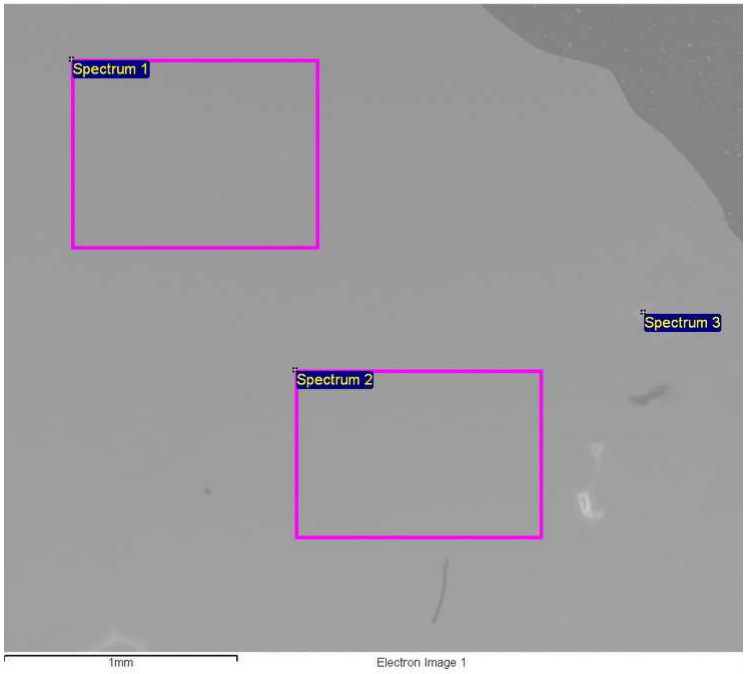
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.0	0.1	1.3	1.1	0.1	1.5	0.1	0.1	0.1	n.d.		
Mg	MgO	2.1	0.1	3.4	2.2	0.1	3.7	0.1	0.0	0.1	n.d.		
Al	Al2O3	1.1	0.0	2.1	1.2	0.0	2.2	n.d.			n.d.		
Si	SiO2	27.4	0.1	58.7	27.9	0.1	59.6	25.5	0.1	54.5	25.6	0.1	54.7
P	P2O5	1.4	0.1	3.2	1.5	0.1	3.4	n.d.			n.d.		
S	SO3	0.1	0.0	0.3	0.1	0.0	0.2	n.d.			n.d.		
Cl		0.5	0.0	0.0	0.6	0.0	0.0	n.d.			n.d.		
K	K2O	7.6	0.1	9.2	8.0	0.1	9.6	0.1	0.0	0.1	0.1	0.0	0.1
Ca	CaO	14.0	0.1	19.6	12.6	0.1	17.6	32.3	0.1	45.2	32.6	0.2	45.6
Ti	TiO2	0.2	0.0	0.3	0.2	0.0	0.3	n.d.			n.d.		
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	0.1	0.0	0.1	n.d.			0.1	0.0	0.1	n.d.		
Mn	MnO	0.5	0.1	0.6	0.5	0.1	0.6	n.d.			n.d.		
Fe	Fe2O3	0.5	0.1	0.7	0.5	0.1	0.7	n.d.			n.d.		
Co	CoO	0.1	0.1	0.1	n.d.			n.d.			n.d.		
Ni	NiO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.			n.d.		
Zn	ZnO	n.d.			n.d.			0.1	0.1	0.1	n.d.		
O		43.6	0.2		43.8	0.2		42.0	0.2		42.0	0.2	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

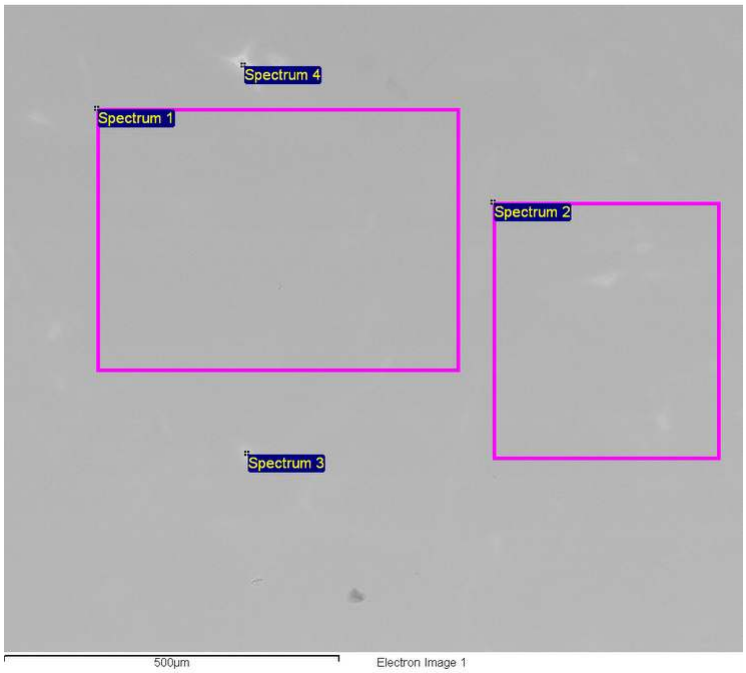
H4A: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Hutton Common slag H4C



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common slag H4C** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.6	0.1	2.2	1.7	0.1	2.2	2.3	0.1	3.1
Mg	MgO	1.3	0.1	2.1	1.3	0.1	2.1	1.6	0.1	2.7
Al	Al2O3	1.6	0.1	3.1	1.6	0.1	3.1	1.9	0.1	3.7
Si	SiO2	29.7	0.2	63.6	29.8	0.2	63.7	31.4	0.2	67.2
P	P2O5	0.9	0.1	2.1	0.8	0.1	1.9	1.0	0.1	2.4
S	SO3	0.2	0.0	0.4	0.2	0.1	0.5	0.2	0.0	0.4
Cl		0.7	0.0	0.0	0.6	0.1	0.0	0.6	0.1	0.0
K	K2O	3.7	0.1	4.4	3.8	0.1	4.5	3.0	0.1	3.6
Ca	CaO	13.8	0.1	19.3	13.9	0.1	19.4	10.9	0.1	15.2
Ti	TiO2	0.2	0.1	0.3	0.1	0.1	0.2	0.1	0.0	0.2
V	V2O5	n.d.			n.d.			n.d.		
Cr	Cr2O3	0.1	0.1	0.1	0.1	0.1	0.1	n.d.		
Mn	MnO	0.3	0.1	0.4	0.2	0.1	0.2	0.1	0.1	0.2
Fe	Fe2O3	0.9	0.1	1.3	1.1	0.1	1.6	0.7	0.1	0.9
Co	CoO	0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.		
Zn	ZnO	n.d.			0.1	0.1	0.1	n.d.		
O		45.0	0.2		45.0	0.2		46.3	0.2	
Totals		100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

H4C: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Hutton Common slag H4C** **Site of Interest 2**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.6	0.1	2.2	1.7	0.1	2.3	2.3	0.1	3.1	2.0	0.1	2.7
Mg	MgO	1.3	0.1	2.2	1.3	0.1	2.2	1.6	0.1	2.7	1.5	0.1	2.5
Al	Al2O3	1.7	0.0	3.2	1.6	0.0	3.1	1.9	0.1	3.5	1.7	0.1	3.3
Si	SiO2	29.8	0.1	63.7	29.8	0.1	63.7	31.1	0.2	66.5	30.3	0.1	64.7
P	P2O5	0.9	0.1	2.1	1.0	0.1	2.3	1.1	0.1	2.5	1.0	0.1	2.3
S	SO3	0.2	0.0	0.5	0.2	0.0	0.4	0.2	0.0	0.5	0.2	0.0	0.5
Cl		0.7	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0
K	K2O	3.7	0.1	4.4	3.6	0.1	4.4	3.1	0.1	3.7	3.3	0.1	4.0
Ca	CaO	13.6	0.1	19.0	13.5	0.1	18.8	11.2	0.1	15.7	12.4	0.1	17.4
Ti	TiO2	0.2	0.0	0.3	0.2	0.0	0.3	0.2	0.0	0.3	0.2	0.0	0.3
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	0.1	0.0	0.1	n.d.			n.d.			n.d.		
Mn	MnO	0.2	0.1	0.2	0.2	0.1	0.3	0.1	0.1	0.1	0.2	0.1	0.3
Fe	Fe2O3	1.0	0.1	1.4	1.0	0.1	1.4	0.6	0.1	0.8	0.9	0.1	1.2
Co	CoO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Zn	ZnO	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
O		45.1	0.2		45.1	0.2		46.1	0.2		45.5	0.2	
Totals		100.0			100.0			100.0			100.0		

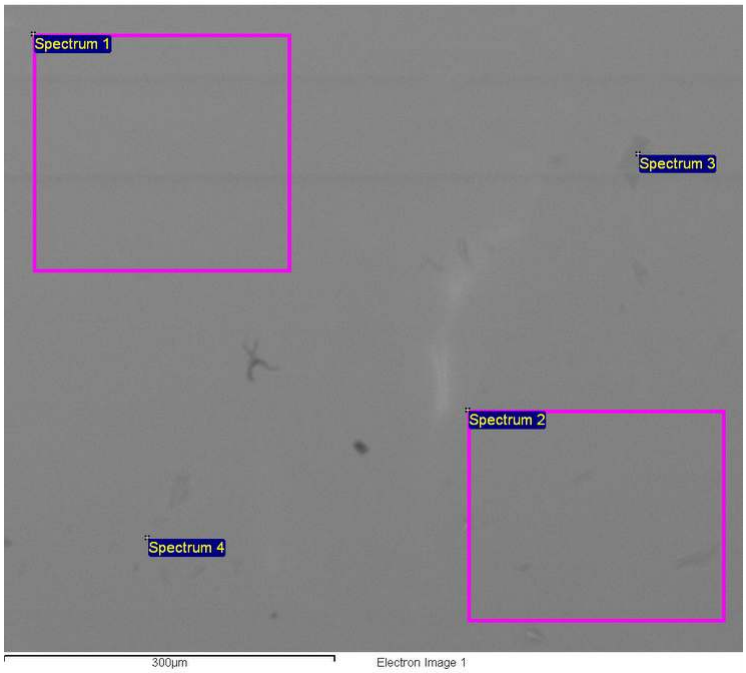
Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

H4C: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Knightons waste K2A

Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Knightons waste K2A** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.0	0.1	1.4	1.1	0.1	1.5	1.0	0.1	1.4	1.1	0.1	1.5
Mg	MgO	3.9	0.1	6.5	4.0	0.1	6.6	4.0	0.1	6.6	4.1	0.1	6.8
Al	Al2O3	0.9	0.1	1.6	0.8	0.1	1.6	0.8	0.1	1.5	0.8	0.1	1.4
Si	SiO2	26.8	0.1	57.4	26.6	0.2	56.8	26.6	0.2	56.9	26.5	0.2	56.6
P	P2O5	1.8	0.1	4.1	1.8	0.1	4.1	1.9	0.1	4.4	1.8	0.1	4.2
S	SO3	0.1	0.0	0.1	0.1	0.0	0.3	0.1	0.0	0.3	0.1	0.0	0.3
Cl		0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0
K	K2O	12.2	0.1	14.7	12.1	0.1	14.6	12.0	0.1	14.5	11.8	0.1	14.3
Ca	CaO	8.6	0.1	12.0	8.9	0.1	12.5	8.7	0.1	12.2	9.0	0.1	12.6
Ti	TiO2	0.2	0.0	0.4	0.2	0.1	0.3	0.2	0.1	0.3	0.1	0.1	0.2
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			n.d.			n.d.			n.d.		
Mn	MnO	0.6	0.1	0.8	0.6	0.1	0.8	0.5	0.1	0.7	0.6	0.1	0.8
Fe	Fe2O3	0.7	0.1	1.0	0.5	0.1	0.8	0.5	0.1	0.7	0.6	0.1	0.9
Co	CoO	n.d.			n.d.			n.d.			0.1	0.1	0.1
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.			n.d.		
Zn	ZnO	n.d.			n.d.			0.1	0.1	0.1	0.1	0.1	0.1
O		43.1	0.2		43.0	0.2		43.0	0.2		43.0	0.2	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

K2A: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Knightons waste K2A** **Site of Interest 2**

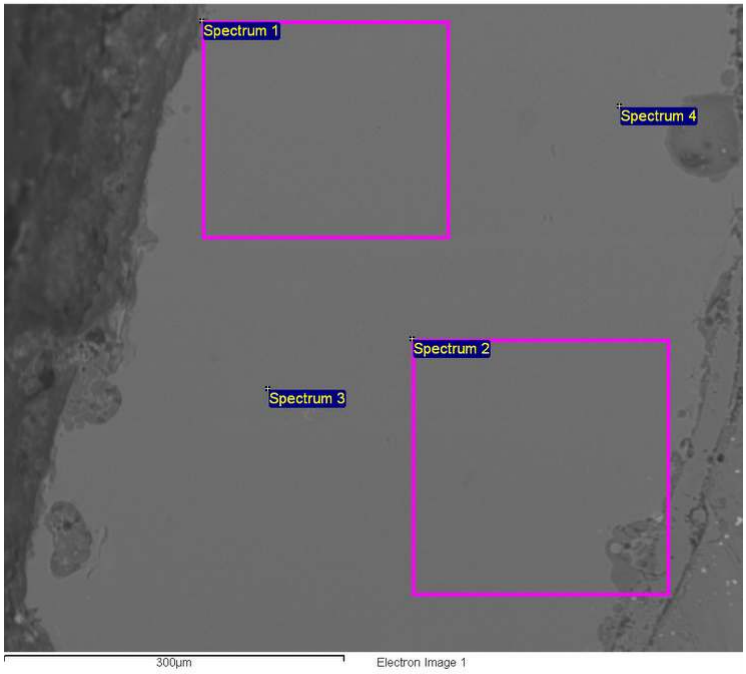
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.1	0.1	1.5	1.1	0.1	1.5	1.1	0.1	1.5	0.9	0.1	1.2
Mg	MgO	4.2	0.1	7.0	4.5	0.1	7.4	4.3	0.1	7.2	4.6	0.1	7.6
Al	Al2O3	0.6	0.1	1.1	0.6	0.1	1.1	0.6	0.1	1.1	0.5	0.1	1.0
Si	SiO2	25.8	0.2	55.2	25.9	0.2	55.4	25.8	0.2	55.1	26.1	0.2	55.9
P	P2O5	2.1	0.1	4.7	1.9	0.1	4.3	2.1	0.1	4.9	1.9	0.1	4.4
S	SO3	0.1	0.0	0.3	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.3
Cl		0.5	0.1	0.0	0.4	0.1	0.0	0.5	0.1	0.0	0.4	0.1	0.0
K	K2O	12.2	0.1	14.7	12.2	0.1	14.7	12.0	0.1	14.4	12.1	0.1	14.6
Ca	CaO	9.5	0.1	13.3	9.6	0.1	13.4	9.4	0.1	13.2	9.6	0.1	13.4
Ti	TiO2	0.1	0.1	0.1	0.2	0.1	0.3	0.1	0.1	0.2	0.1	0.1	0.1
V	V2O5	0.1	0.1	0.1	0.1	0.1	0.1	n.d.			n.d.		
Cr	Cr2O3	0.1	0.1	0.1	0.1	0.1	0.1	n.d.			0.1	0.1	0.1
Mn	MnO	0.5	0.1	0.7	0.6	0.1	0.7	0.6	0.1	0.8	0.6	0.1	0.7
Fe	Fe2O3	0.5	0.1	0.7	0.4	0.1	0.5	0.4	0.1	0.6	0.3	0.1	0.4
Co	CoO	n.d.			n.d.			0.1	0.1	0.1	n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			0.2	0.1	0.2	0.1	0.1	0.1
Zn	ZnO	n.d.			n.d.			0.1	0.2	0.1	n.d.		
O		42.7	0.2		42.7	0.3		42.7	0.3		42.8	0.3	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

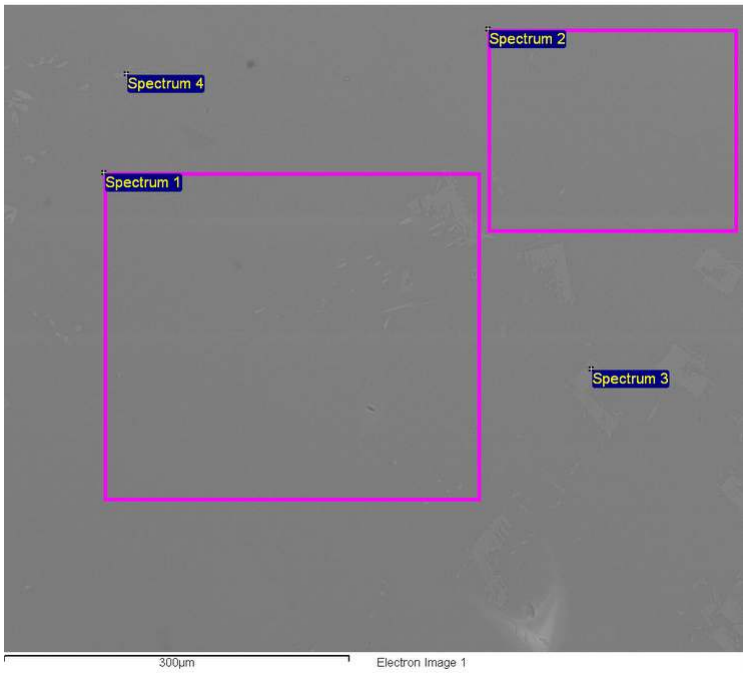
K2A: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Knightons waste K1



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Knightons waste K1** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.3	0.1	1.7	1.2	0.1	1.6	1.4	0.1	1.9	1.5	0.1	2.0
Mg	MgO	4.1	0.1	6.7	4.0	0.1	6.6	4.1	0.1	6.8	3.9	0.1	6.5
Al	Al2O3	1.2	0.1	2.2	1.2	0.1	2.2	1.2	0.1	2.3	1.2	0.1	2.3
Si	SiO2	26.7	0.2	57.2	26.7	0.2	57.0	26.8	0.2	57.3	27.0	0.2	57.8
P	P2O5	1.6	0.1	3.8	1.9	0.1	4.3	1.5	0.1	3.5	1.5	0.1	3.5
S	SO3	n.d.			0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2
Cl		0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0
K	K2O	10.4	0.1	12.5	9.7	0.1	11.7	10.2	0.1	12.2	10.6	0.1	12.8
Ca	CaO	9.5	0.1	13.3	9.8	0.1	13.8	9.4	0.1	13.2	9.2	0.1	12.8
Ti	TiO2	0.2	0.1	0.3	0.2	0.1	0.4	0.2	0.1	0.3	0.2	0.1	0.4
V	V2O5	n.d.			n.d.			n.d.			0.1	0.1	0.1
Cr	Cr2O3	n.d.			n.d.			n.d.			n.d.		
Mn	MnO	0.9	0.1	1.1	0.9	0.1	1.2	0.8	0.1	1.1	0.9	0.1	1.2
Fe	Fe2O3	0.7	0.1	1.0	0.8	0.1	1.2	0.8	0.1	1.1	0.8	0.1	1.2
Co	CoO	0.1	0.1	0.1	n.d.			0.1	0.1	0.2	n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			0.1	0.1	0.1	0.1	0.1	0.1	n.d.		
Zn	ZnO	0.1	0.2	0.1	0.1	0.2	0.1	n.d.			n.d.		
O		43.3	0.3		43.6	0.3		43.3	0.3		43.5	0.3	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

K1: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Knightons waste K1** **Site of Interest 2**

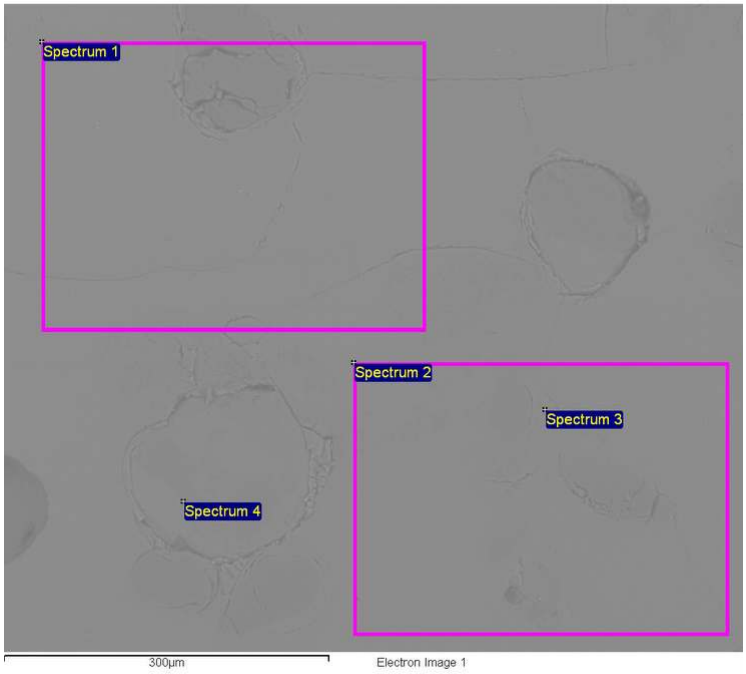
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.5	0.1	2.0	1.4	0.1	1.9	0.1	0.1	0.2	0.9	0.1	1.2
Mg	MgO	4.0	0.1	6.6	4.3	0.1	7.1	1.2	0.1	1.9	1.9	0.1	3.2
Al	Al2O3	1.2	0.1	2.3	1.2	0.1	2.3	n.d.			0.1	0.1	0.2
Si	SiO2	27.0	0.2	57.7	27.2	0.2	58.1	25.3	0.2	54.2	2.2	0.1	4.7
P	P2O5	1.6	0.1	3.7	1.5	0.1	3.5	0.1	0.1	0.1	19.4	0.2	44.6
S	SO3	n.d.			n.d.			n.d.			n.d.		
Cl		0.1	0.1	0.0	n.d.			n.d.			n.d.		
K	K2O	10.3	0.1	12.4	10.6	0.1	12.7	0.2	0.1	0.3	2.4	0.1	2.9
Ca	CaO	9.1	0.1	12.8	8.4	0.1	11.7	30.1	0.2	42.1	30.7	0.2	42.9
Ti	TiO2	0.2	0.1	0.3	0.2	0.1	0.4	n.d.			n.d.		
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Mn	MnO	0.8	0.1	1.0	0.9	0.1	1.1	0.7	0.1	0.9	0.2	0.1	0.3
Fe	Fe2O3	0.7	0.1	1.0	0.7	0.1	1.0	0.1	0.1	0.1	0.1	0.1	0.1
Co	CoO	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	n.d.		
Ni	NiO	0.1	0.1	0.1	n.d.			n.d.			0.1	0.1	0.1
Cu	CuO	n.d.			n.d.			n.d.			0.1	0.1	0.1
Zn	ZnO	0.1	0.2	0.1	n.d.			n.d.			n.d.		
O		43.4	0.3		43.6	0.3		42.1	0.3		42.1	0.3	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

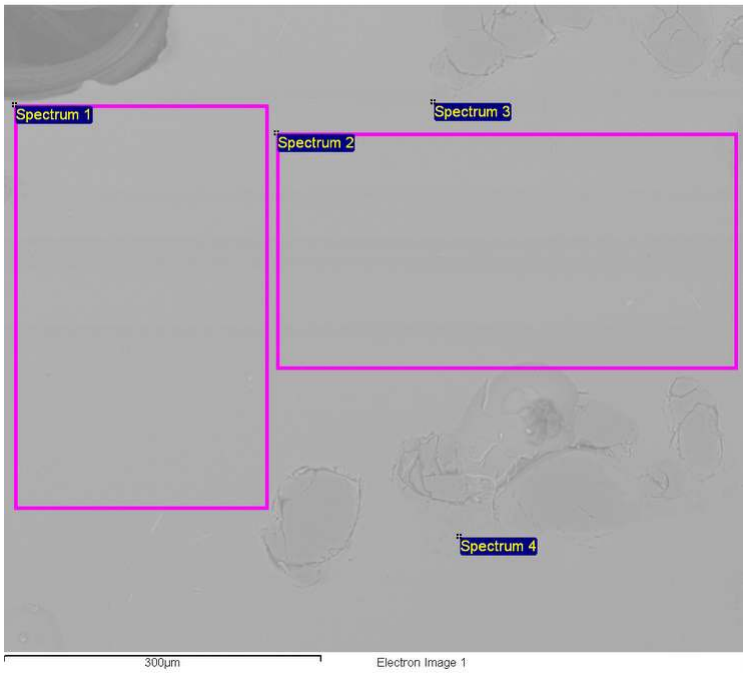
K1: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – Knightons waste K5



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Knightons waste K5** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	0.5	0.1	0.6	0.4	0.1	0.5	0.3	0.1	0.4	0.2	0.1	0.2
Mg	MgO	0.5	0.0	0.9	0.4	0.0	0.7	0.4	0.0	0.7	0.2	0.0	0.3
Al	Al2O3	2.6	0.1	4.9	2.7	0.1	5.1	3.3	0.1	6.2	1.3	0.0	2.4
Si	SiO2	37.9	0.1	81.1	38.8	0.1	83.0	38.9	0.2	83.1	42.7	0.2	91.3
P	P2O5	0.1	0.0	0.1	0.1	0.0	0.2	n.d.			0.1	0.0	0.3
S	SO3	n.d.			n.d.			n.d.			n.d.		
Cl		n.d.			n.d.			n.d.			n.d.		
K	K2O	5.6	0.1	6.8	5.3	0.1	6.4	5.5	0.1	6.6	2.7	0.1	3.2
Ca	CaO	0.4	0.0	0.5	0.4	0.0	0.5	0.3	0.0	0.4	0.2	0.0	0.2
Ti	TiO2	0.1	0.0	0.2	0.1	0.0	0.2	0.1	0.0	0.2	n.d.		
V	V2O5	n.d.			n.d.			0.1	0.0	0.1	n.d.		
Cr	Cr2O3	n.d.			n.d.			0.1	0.0	0.1	n.d.		
Mn	MnO	n.d.			n.d.			n.d.			0.1	0.0	0.1
Fe	Fe2O3	3.2	0.1	4.6	2.4	0.1	3.4	1.5	0.1	2.1	1.3	0.1	1.8
Co	CoO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.			n.d.		
Zn	ZnO	n.d.			n.d.			n.d.			0.1	0.1	0.2
O		49.0	0.2		49.4	0.2		49.6	0.2		51.3	0.2	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

K5: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **Knightons waste K5** **Site of Interest 2**

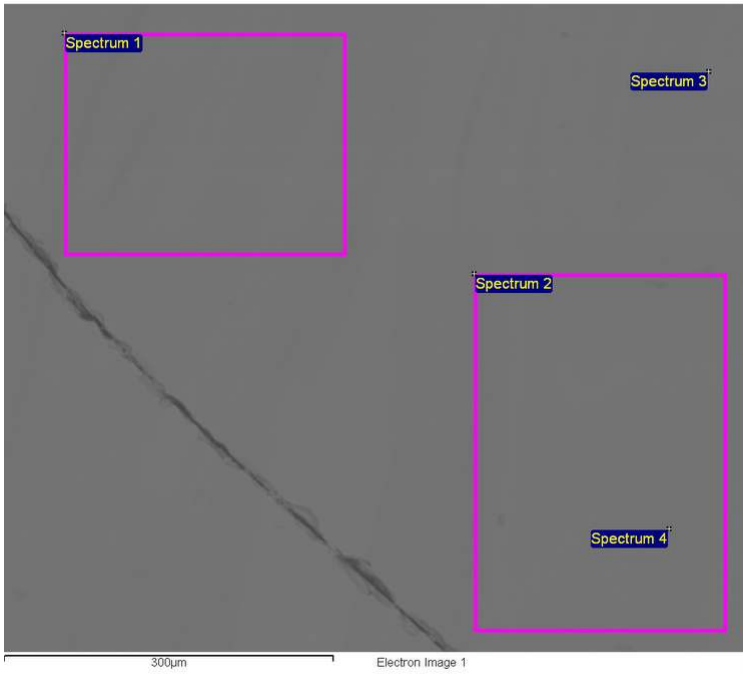
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	0.5	0.1	0.6	0.6	0.1	0.8	0.6	0.1	0.7	0.4	0.1	0.5
Mg	MgO	1.0	0.1	1.6	0.8	0.1	1.3	0.8	0.1	1.3	0.6	0.1	1.0
Al	Al2O3	2.3	0.1	4.3	2.7	0.1	5.0	2.5	0.1	4.7	2.6	0.1	4.9
Si	SiO2	36.8	0.2	78.8	36.7	0.2	78.5	37.5	0.2	80.2	38.2	0.2	81.8
P	P2O5	0.2	0.1	0.4	0.1	0.1	0.2	0.1	0.1	0.2	n.d.		
S	SO3	n.d.			n.d.			n.d.			n.d.		
Cl		0.1	0.0	0.0	n.d.			0.1	0.0	0.0	n.d.		
K	K2O	6.0	0.1	7.2	6.2	0.1	7.5	5.9	0.1	7.1	5.6	0.1	6.7
Ca	CaO	1.9	0.1	2.7	1.2	0.1	1.7	1.2	0.1	1.6	0.7	0.1	1.0
Ti	TiO2	0.2	0.0	0.3	0.2	0.0	0.3	0.2	0.0	0.3	0.2	0.1	0.3
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			0.1	0.0	0.1	n.d.			n.d.		
Mn	MnO	0.2	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
Fe	Fe2O3	2.6	0.1	3.7	3.0	0.1	4.3	2.5	0.1	3.5	2.4	0.1	3.5
Co	CoO	n.d.			n.d.			n.d.			0.1	0.1	0.1
Ni	NiO	0.1	0.1	0.1	n.d.			0.1	0.1	0.1	n.d.		
Cu	CuO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Zn	ZnO	n.d.			n.d.			n.d.			n.d.		
O		48.3	0.2		48.3	0.2		48.7	0.2		49.1	0.2	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

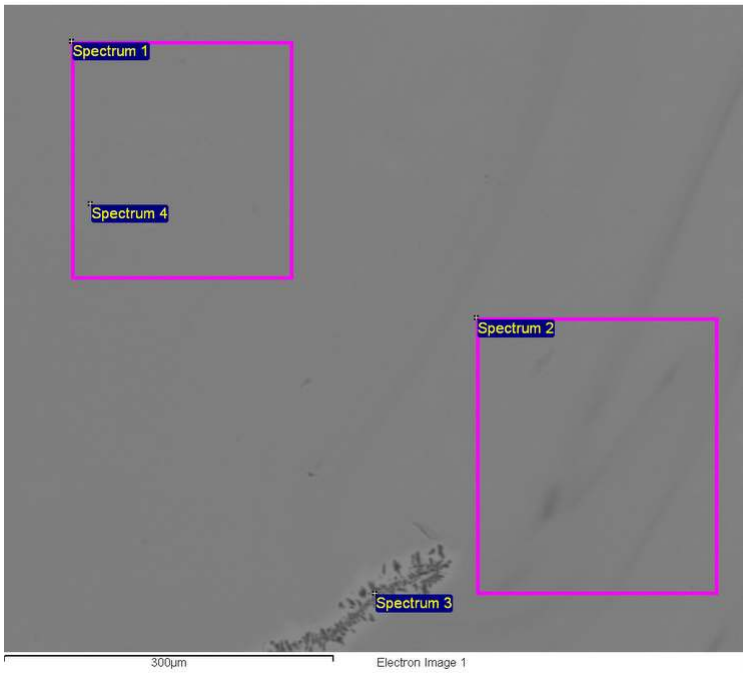
K5: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – St. Aidan's waste 2110-A



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **St. Aidan's 2110-A** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	0.2	0.1	0.3	0.1	0.1	0.2	0.3	0.1	0.3	n.d.		
Mg	MgO	0.1	0.1	0.1	n.d.			0.1	0.1	0.1	n.d.		
Al	Al2O3	0.5	0.0	1.0	0.5	0.1	1.0	0.2	0.0	0.4	0.6	0.1	1.1
Si	SiO2	36.9	0.2	79.0	37.0	0.2	79.1	37.1	0.2	79.4	36.8	0.2	78.6
P	P2O5	0.1	0.1	0.3	0.1	0.1	0.2	n.d.			0.2	0.1	0.4
S	SO3	3.6	0.1	8.9	3.6	0.1	9.0	3.8	0.1	9.6	3.7	0.1	9.2
Cl		0.6	0.1	0.0	0.6	0.1	0.0	0.6	0.1	0.0	0.7	0.1	0.0
K	K2O	7.1	0.1	8.5	7.2	0.1	8.7	7.0	0.1	8.4	7.1	0.1	8.5
Ca	CaO	0.4	0.1	0.5	0.7	0.1	1.0	0.5	0.1	0.7	0.7	0.1	1.0
Ti	TiO2	n.d.			n.d.			n.d.			0.1	0.1	0.2
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			n.d.			0.1	0.1	0.1	n.d.		
Mn	MnO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Fe	Fe2O3	0.2	0.1	0.3	0.1	0.1	0.2	0.3	0.1	0.4	0.2	0.1	0.3
Co	CoO	0.2	0.1	0.2	0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	0.1	0.1	0.1	n.d.			n.d.			n.d.		
Cu	CuO	0.1	0.1	0.2	0.1	0.1	0.1	n.d.			n.d.		
Zn	ZnO	n.d.			n.d.			n.d.			0.2	0.2	0.2
O		50.0	0.2		49.9	0.2		50.2	0.3		50.0	0.2	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 2
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

2110-A: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **St. Aidan's 2110-A** **Site of Interest 2**

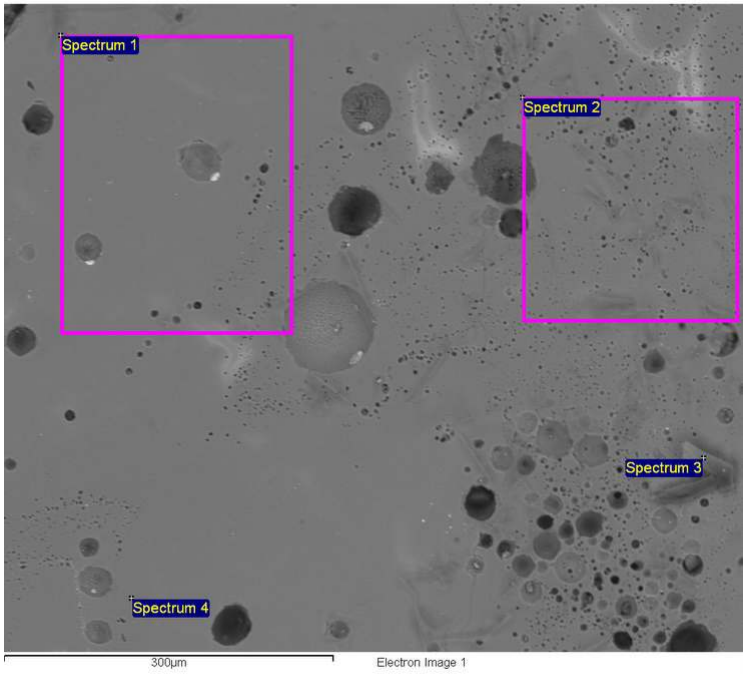
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.3
Mg	MgO	n.d.			0.1	0.1	0.1	0.1	0.0	0.1	n.d.		
Al	Al2O3	0.1	0.1	0.2	0.3	0.1	0.6	n.d.			0.1	0.0	0.2
Si	SiO2	37.0	0.2	79.1	36.9	0.2	79.0	42.9	0.2	91.8	37.0	0.2	79.2
P	P2O5	0.1	0.1	0.3	0.1	0.1	0.3	n.d.			0.1	0.1	0.1
S	SO3	4.0	0.1	10.0	4.0	0.1	9.9	1.7	0.1	4.3	4.2	0.1	10.5
Cl		0.7	0.1	0.0	0.7	0.1	0.0	0.3	0.0	0.0	0.7	0.1	0.0
K	K2O	7.6	0.1	9.2	7.5	0.1	9.0	2.8	0.1	3.4	7.3	0.1	8.8
Ca	CaO	n.d.			0.1	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.1
Ti	TiO2	n.d.			n.d.			n.d.			0.1	0.1	0.1
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			n.d.			n.d.			n.d.		
Mn	MnO	n.d.			n.d.			n.d.			n.d.		
Fe	Fe2O3	n.d.			0.2	0.1	0.2	n.d.			n.d.		
Co	CoO	0.1	0.1	0.2	0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.			0.1	0.1	0.2
Cu	CuO	0.1	0.1	0.1	n.d.			n.d.			n.d.		
Zn	ZnO	0.1	0.2	0.1	n.d.			n.d.			n.d.		
O		50.1	0.3		50.1	0.3		52.1	0.2		50.3	0.3	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 2
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

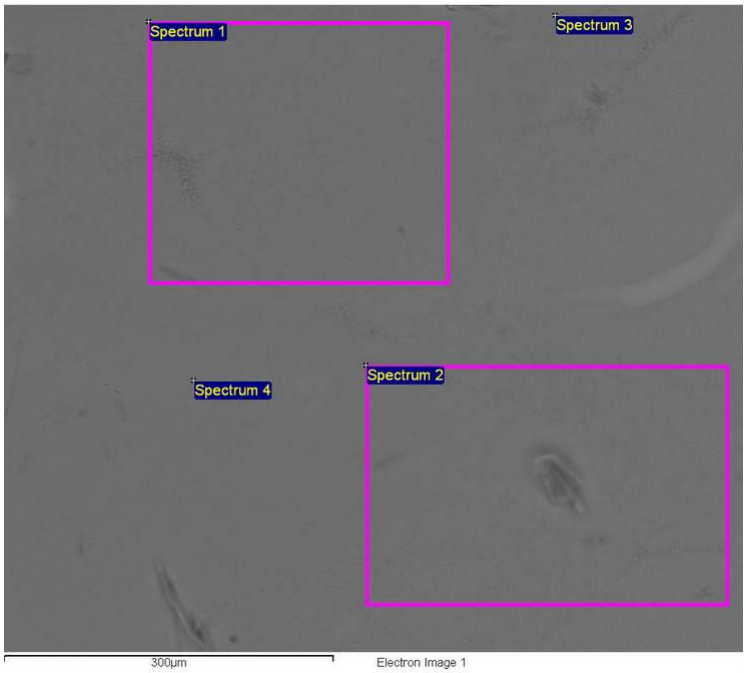
2110-A: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – St. Aidan's waste 2110-D



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **St. Aidan's 2110-D** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.2	0.1	1.7	2.0	0.1	2.7	2.1	0.1	2.9	1.9	0.1	2.6
Mg	MgO	2.0	0.0	3.3	1.2	0.0	2.0	0.8	0.0	1.3	1.5	0.0	2.5
Al	Al2O3	4.2	0.1	8.0	8.5	0.1	16.0	11.5	0.1	21.8	6.5	0.1	12.3
Si	SiO2	30.5	0.1	65.3	27.2	0.1	58.2	26.2	0.1	56.0	29.3	0.1	62.7
P	P2O5	0.3	0.0	0.6	0.1	0.0	0.3	0.2	0.0	0.4	0.2	0.0	0.5
S	SO3	0.2	0.0	0.5	0.2	0.0	0.5	0.2	0.0	0.4	0.1	0.0	0.3
Cl		0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
K	K2O	1.5	0.0	1.8	0.3	0.0	0.4	0.2	0.0	0.2	0.8	0.0	0.9
Ca	CaO	11.3	0.1	15.8	12.2	0.1	17.1	10.9	0.1	15.2	11.3	0.1	15.8
Ti	TiO2	0.3	0.0	0.4	0.4	0.0	0.6	0.3	0.0	0.6	0.3	0.0	0.5
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	0.1	0.0	0.1	n.d.			n.d.			n.d.		
Mn	MnO	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1
Fe	Fe2O3	1.6	0.1	2.3	1.3	0.1	1.8	0.6	0.1	0.9	1.4	0.1	1.9
Co	CoO	n.d.			n.d.			0.1	0.0	0.1	0.1	0.1	0.1
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	n.d.			n.d.			n.d.			n.d.		
Zn	ZnO	n.d.			0.1	0.1	0.2	n.d.			n.d.		
O		46.7	0.1		46.3	0.1		46.8	0.2		46.7	0.1	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

2110-D: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **St. Aidan's 2110-D** **Site of Interest 2**

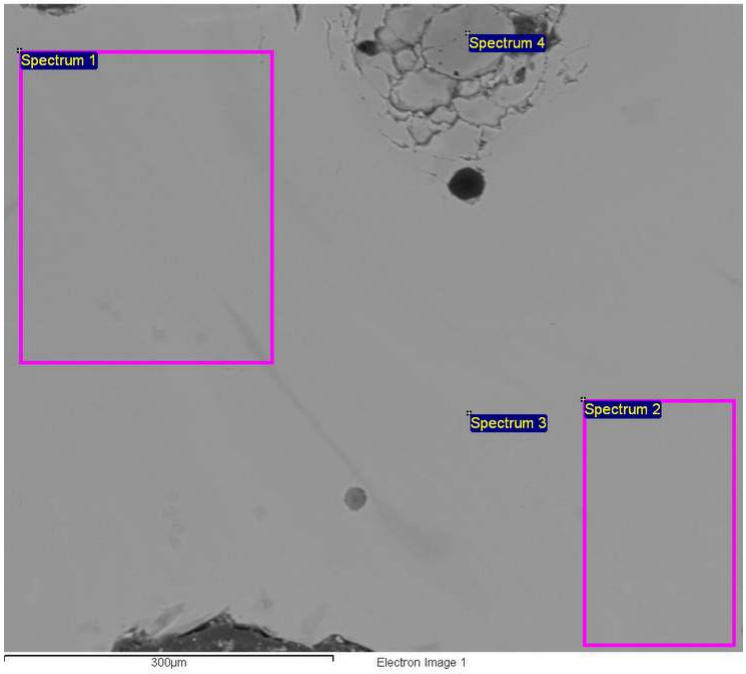
		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.8	0.1	2.4	1.9	0.1	2.5	1.0	0.1	1.3	1.0	0.1	1.3
Mg	MgO	2.3	0.0	3.8	2.2	0.0	3.6	2.1	0.0	3.5	2.3	0.0	3.7
Al	Al2O3	2.6	0.0	5.0	2.8	0.0	5.4	2.5	0.0	4.8	2.7	0.0	5.1
Si	SiO2	31.5	0.1	67.5	31.8	0.1	68.1	31.9	0.1	68.3	31.6	0.1	67.5
P	P2O5	0.3	0.0	0.7	0.4	0.0	0.8	0.3	0.0	0.7	0.4	0.0	0.9
S	SO3	0.1	0.0	0.1	n.d.			n.d.			n.d.		
Cl		0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
K	K2O	1.6	0.0	1.9	1.7	0.0	2.1	1.6	0.0	1.9	1.6	0.0	2.0
Ca	CaO	11.2	0.1	15.7	10.3	0.1	14.4	12.2	0.1	17.1	11.7	0.1	16.4
Ti	TiO2	0.1	0.0	0.2	0.2	0.0	0.4	0.2	0.0	0.3	0.2	0.0	0.3
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			n.d.			n.d.			0.1	0.0	0.1
Mn	MnO	n.d.			0.1	0.0	0.1	n.d.			0.1	0.0	0.1
Fe	Fe2O3	1.7	0.1	2.5	1.7	0.1	2.4	1.4	0.1	2.0	1.7	0.1	2.4
Co	CoO	n.d.			0.1	0.1	0.1	n.d.			n.d.		
Ni	NiO	n.d.			n.d.			n.d.			n.d.		
Cu	CuO	0.1	0.1	0.1	n.d.			n.d.			0.1	0.1	0.1
Zn	ZnO	n.d.			n.d.			n.d.			n.d.		
O		46.5	0.1		46.8	0.1		46.7	0.1		46.6	0.1	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

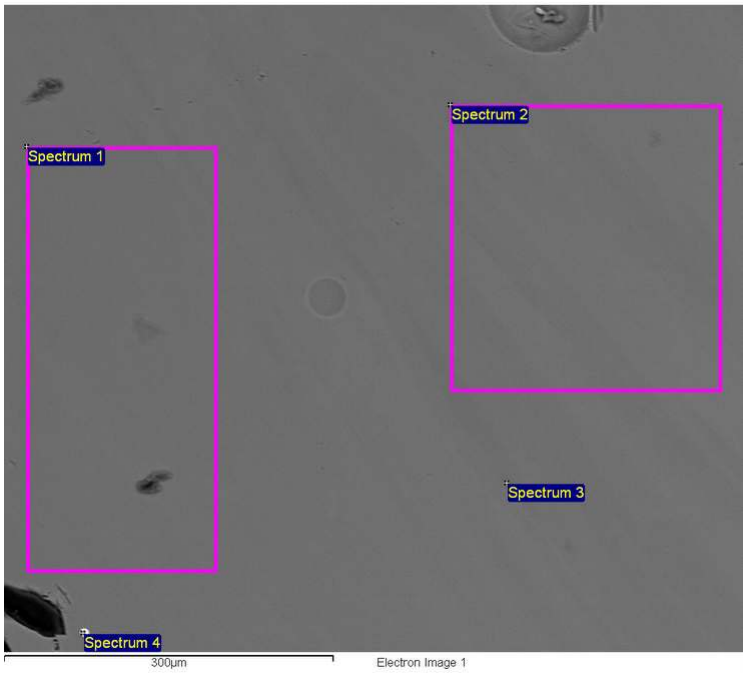
2110-D: Site of interest 2 spectra analysis

SCANNING ELECTRON MICROSCOPY

Sample: Glass production residues – St. Aidan's waste 2110-C



Site of interest 1



Site of interest 2

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **St. Aidan's 2110-C** **Site of Interest 1**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.5	0.1	2.0	1.5	0.1	2.0	1.2	0.1	1.6	n.d.		
Mg	MgO	2.0	0.0	3.3	2.0	0.0	3.3	2.3	0.0	3.7	n.d.		
Al	Al2O3	3.9	0.1	7.3	3.7	0.0	7.0	3.3	0.0	6.3	n.d.		
Si	SiO2	31.3	0.1	67.0	31.5	0.1	67.3	31.1	0.1	66.6	46.7	0.1	99.9
P	P2O5	0.3	0.0	0.8	0.3	0.0	0.7	0.4	0.0	0.9	0.1	0.0	0.2
S	SO3	n.d.			n.d.			n.d.			n.d.		
Cl		n.d.			0.1	0.0	0.0	0.1	0.0	0.0	n.d.		
K	K2O	1.4	0.0	1.7	1.3	0.0	1.6	1.2	0.0	1.4	n.d.		
Ca	CaO	10.1	0.1	14.2	10.0	0.1	14.0	11.0	0.1	15.4	n.d.		
Ti	TiO2	0.3	0.0	0.4	0.2	0.0	0.4	0.2	0.0	0.4	n.d.		
V	V2O5	n.d.			0.1	0.0	0.1	n.d.			n.d.		
Cr	Cr2O3	n.d.			n.d.			0.1	0.0	0.1	n.d.		
Mn	MnO	n.d.			0.1	0.0	0.1	n.d.			n.d.		
Fe	Fe2O3	2.2	0.1	3.2	2.2	0.1	3.2	2.4	0.1	3.4	n.d.		
Co	CoO	n.d.			0.1	0.0	0.1	n.d.			n.d.		
Ni	NiO	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	n.d.		
Cu	CuO	n.d.			n.d.			n.d.			n.d.		
Zn	ZnO	n.d.			n.d.			n.d.			n.d.		
O		46.9	0.1		46.9	0.1		46.7	0.1		53.3	0.1	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

2110-C: Site of interest 1 spectra analysis

SCANNING ELECTRON MICROSCOPY

Glass working residues **Sample** **St. Aidan's 2110-C** **Site of Interest 2**

		Spectrum 1: Area			Spectrum 2: Area			Spectrum 3: Phase			Spectrum 4: Phase		
Element	Formula	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%	Weight%	Weight% sigma	Compound%
Na	Na2O	1.5	0.1	2.0	1.6	0.1	2.1	1.5	0.1	2.1	n.d.		
Mg	MgO	2.0	0.0	3.3	1.9	0.0	3.1	1.4	0.0	2.3	n.d.		
Al	Al2O3	3.7	0.1	7.0	4.0	0.1	7.5	4.5	0.1	8.6	n.d.		
Si	SiO2	31.6	0.1	67.6	31.8	0.1	67.9	32.9	0.1	70.5	0.3	0.0	0.6
P	P2O5	0.3	0.0	0.7	0.3	0.0	0.7	0.3	0.0	0.6	n.d.		
S	SO3	n.d.			n.d.			n.d.			21.1	0.1	52.8
Cl		0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	n.d.		
K	K2O	1.4	0.0	1.7	1.4	0.0	1.7	1.7	0.0	2.1	n.d.		
Ca	CaO	9.8	0.1	13.7	9.1	0.1	12.7	7.4	0.1	10.4	0.2	0.0	0.3
Ti	TiO2	0.2	0.0	0.4	0.3	0.0	0.5	0.3	0.0	0.5	n.d.		
V	V2O5	n.d.			n.d.			n.d.			n.d.		
Cr	Cr2O3	n.d.			0.1	0.0	0.1	n.d.			n.d.		
Mn	MnO	0.1	0.0	0.1	n.d.			0.1	0.0	0.1	n.d.		
Fe	Fe2O3	2.3	0.1	3.3	2.3	0.1	3.2	2.0	0.1	2.8	28.9	0.1	41.4
Co	CoO	n.d.			n.d.			n.d.			0.3	0.1	0.4
Ni	NiO	n.d.			n.d.			n.d.			1.6	0.1	2.0
Cu	CuO	n.d.			0.1	0.1	0.1	n.d.			2.1	0.1	2.6
Zn	ZnO	n.d.			0.2	0.1	0.2	n.d.			n.d.		
O		46.9	0.1		47.1	0.1		47.8	0.1		45.5	0.1	
Totals		100.0			100.0			100.0			100.0		

Processing option : Oxygen by stoichiometry (Normalised) n.d. = not detected
Number of iterations : 3
Sample is polished.
Sample is coated with Carbon - thickness (nm): 15.0, density (g/cm3): 2.25
Detector efficiency : Calculation

2110-C: Site of interest 2 spectra analysis