The road to net zero, the testing of a new hybrid fuel for sintering

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Iron ore sintering and its impacts

- But what if we used “new” carbon to curve the lifecycle and offset carbon emissions.

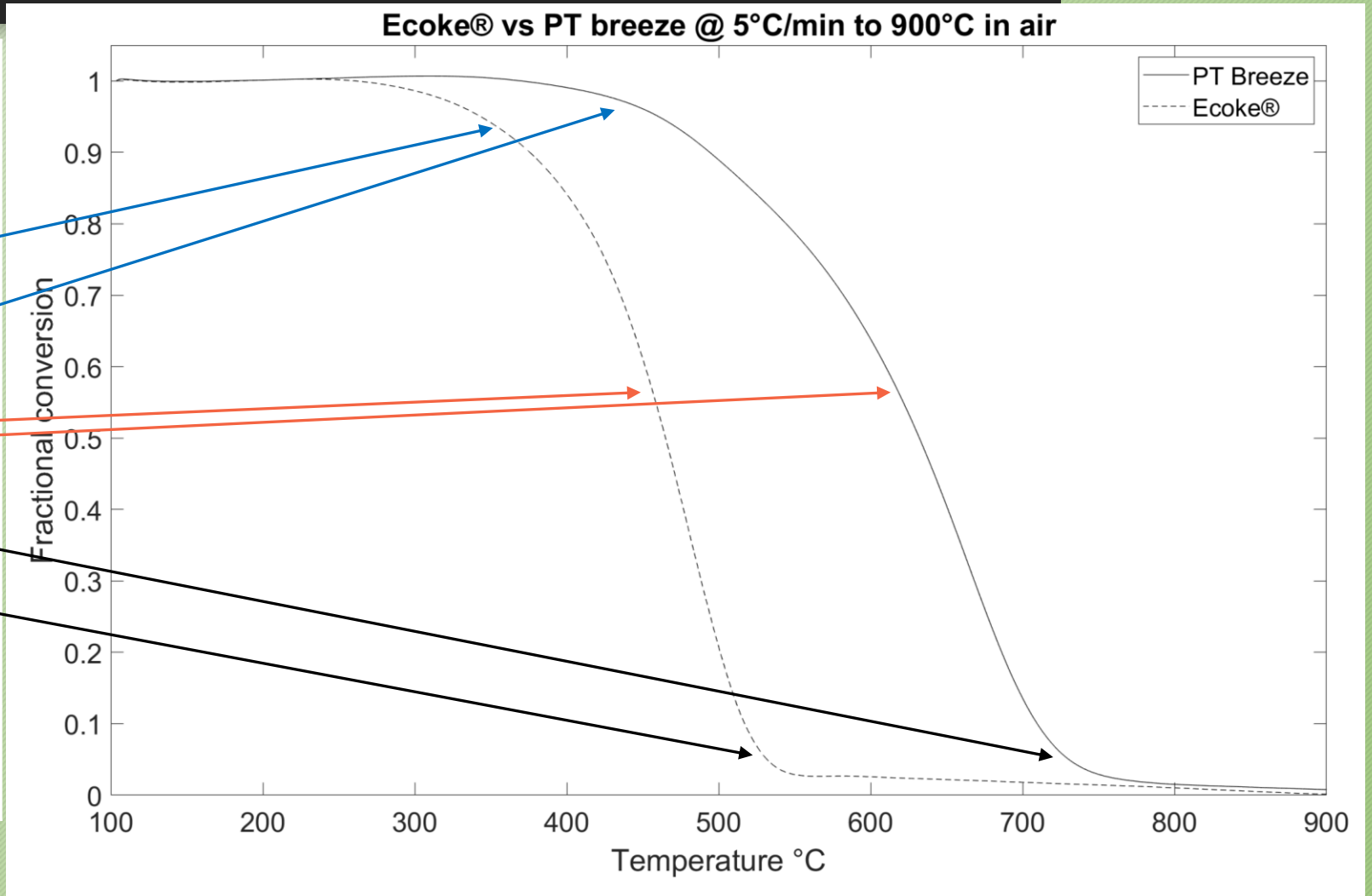
- A crucial process to convert low cost iron ore fines to blast furnace feed.
- Typically “ancient” carbon provides the heat flux to agglomerate the ores.
- Results in an unsustainable linear lifecycle.

PT breeze vs Ecoke®

Sample	Proximate analysis (% by mass)			Calorific value (MJ/kg)
	Fixed Carbon	Volatile Matter	Ash	
Ecoke®	78.7	13.3	8.9	27.9
PT Breeze	83.4	7.4	9.2	26.5

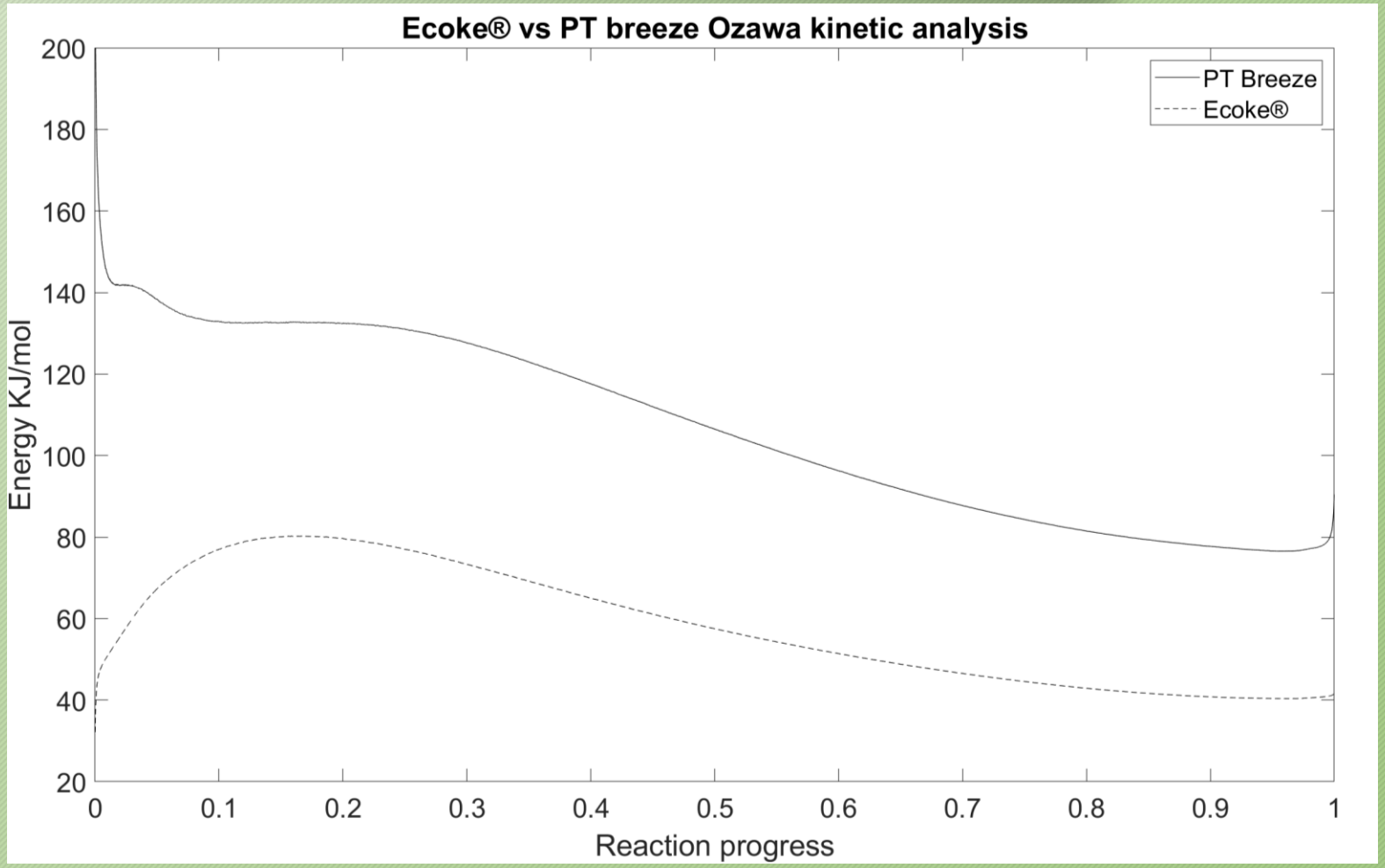
Burnout properties

	Ecoke®	PT breeze
5 °C/min		
T_i (°C)	406	545
T_1(°C)	478	662
T_b(°C)	523	724
R_{max} (mg/min)	0.42	0.25
R_{av} (mg/min)	0.10	0.09



Reaction Kinetics

Parameter	ecoke®	PT Breeze
E_{actF} (kJ/mol)	79.8	138.0
A_F	6.6	13.9
E_{actO}	80.2	141.5



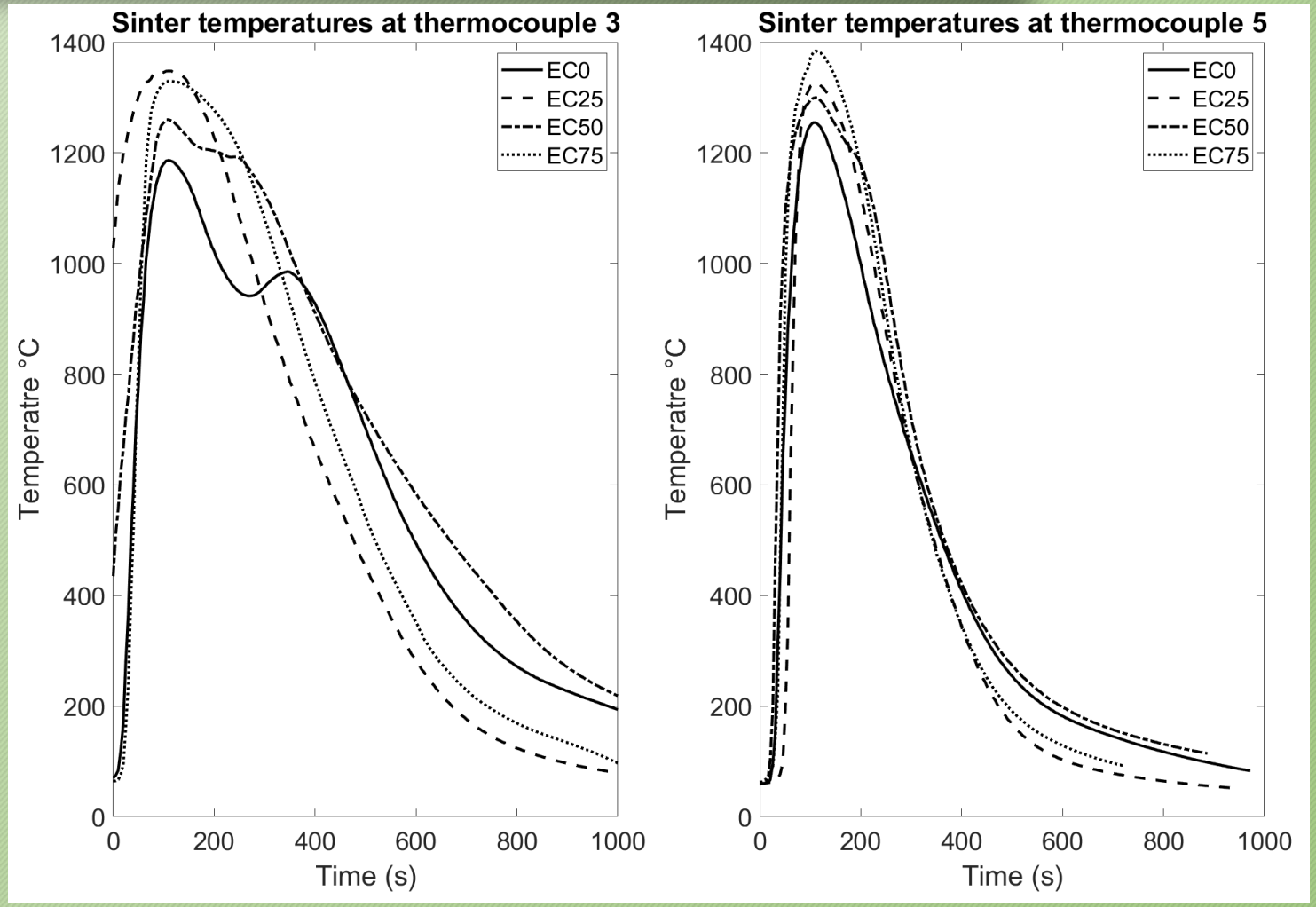
Sintering experiments

Iron baring material	%
Ore A	19.34
Ore B	25.07
Ore C	21.25
Ore D	19.34
Sinter fines	15.00

Sinter conditions	Value
Moisture	6.5%
Fuel rate	7%

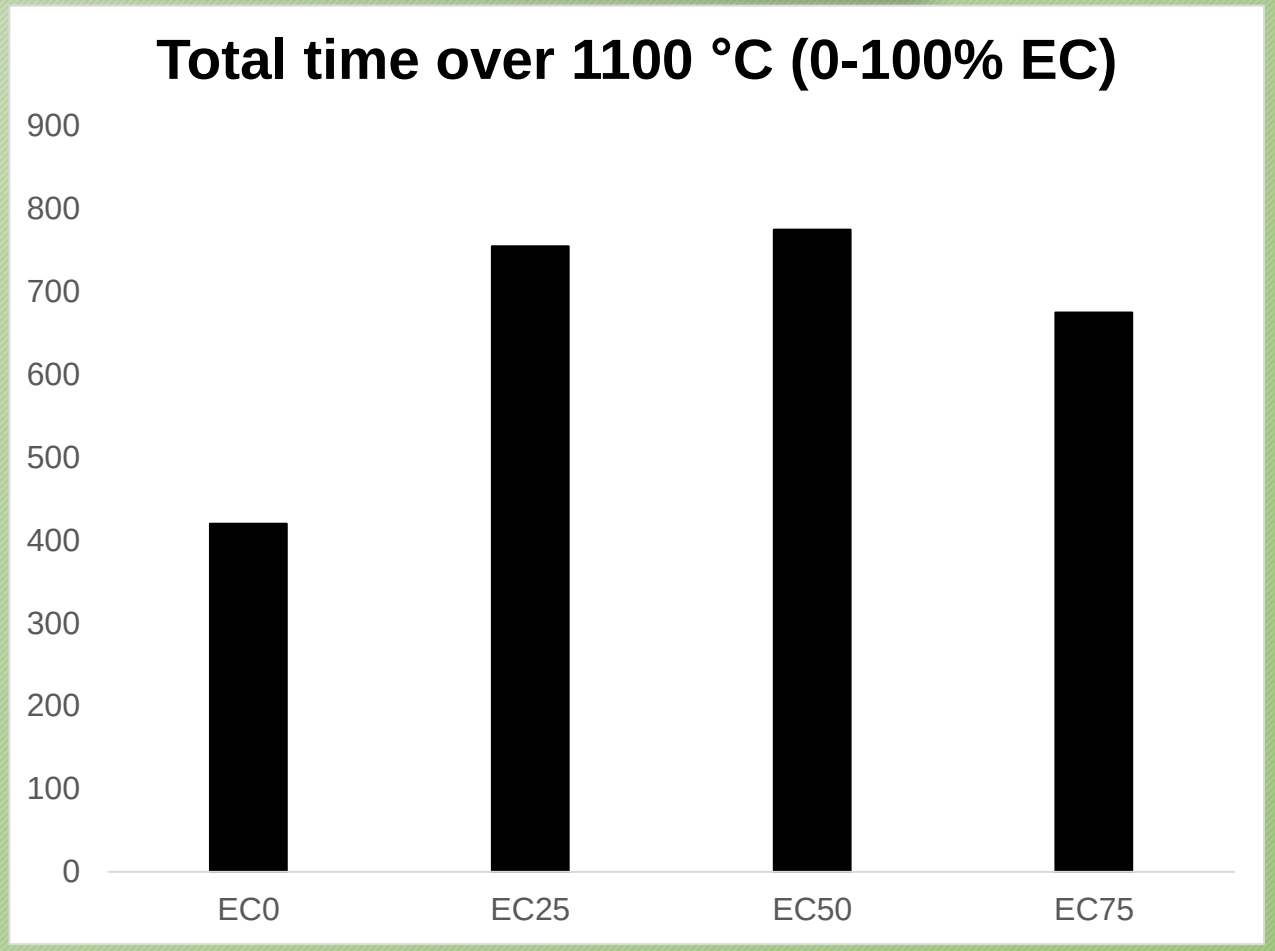
Sintering results

- With increasing Ecoke® content maximum temperatures within the pot rise at both TC 3 and TC 5.
- Maximum temperature at both TC 3 and 5 achieved by the EC75 blend.
- Little adverse affect on the sinter temperature profile is seen with increasing Ecoke® content.



Sintering results cont…

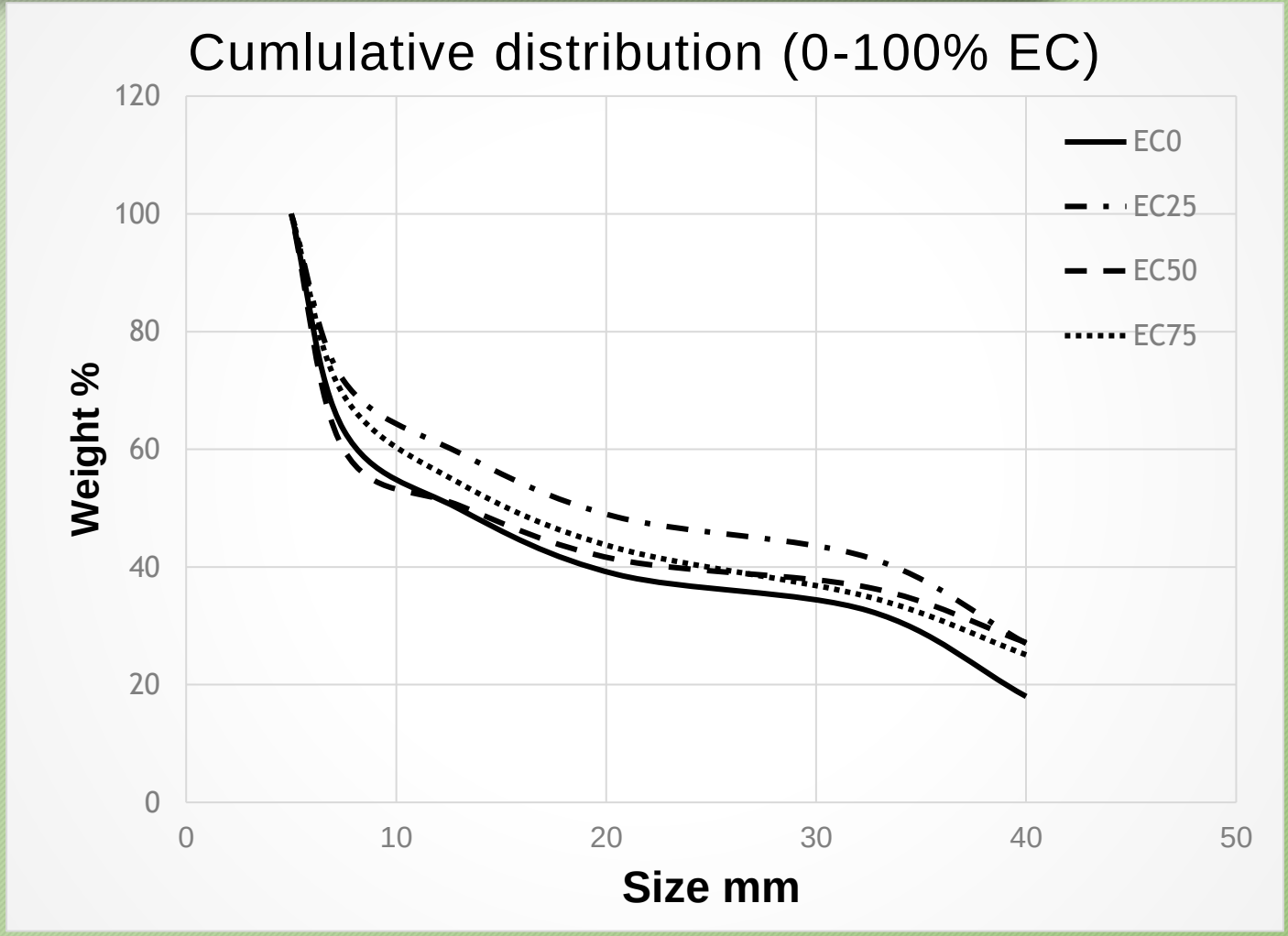
- Time spent over 1100 °C increases up to EC50
- Decreases at EC75 in contrast with higher maximum temperature



Yield and size distribution

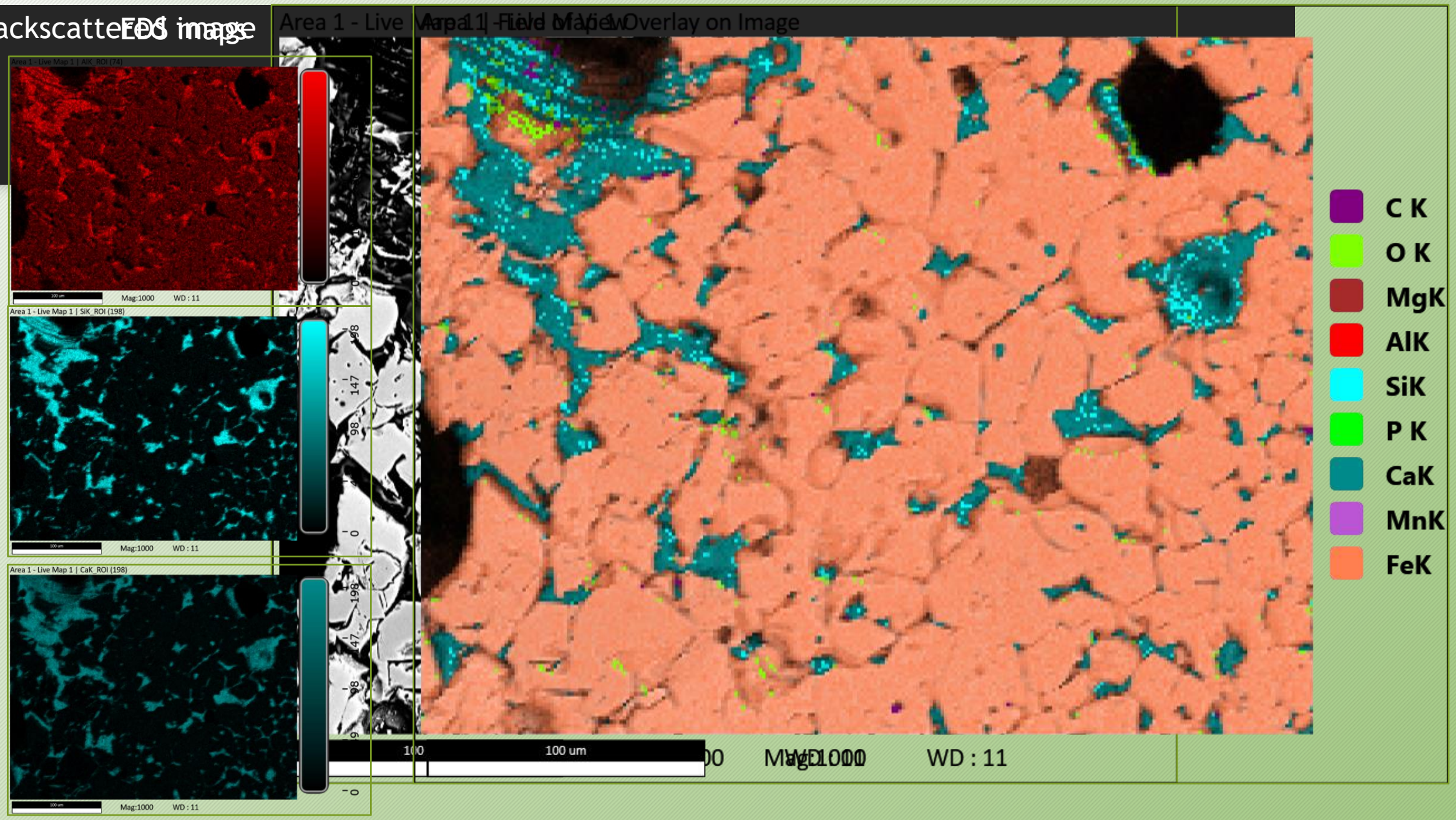
Sample	Yield
EC0	63.24
EC25	71.64
EC50	60.32
EC75	69.16

- Yield increases at EC25
- Drops slightly at EC75 but still higher than EC0
- All Ecoke® blends have a higher proportion of +15mm sinter than EC0



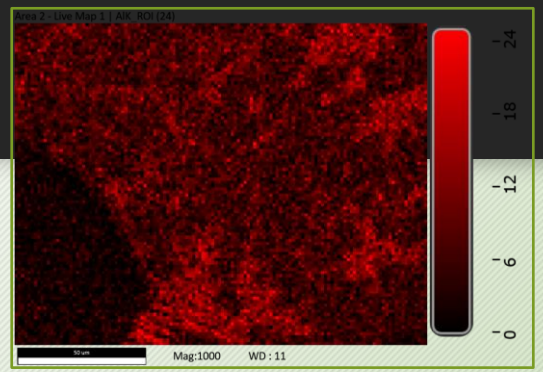
Backscattered image

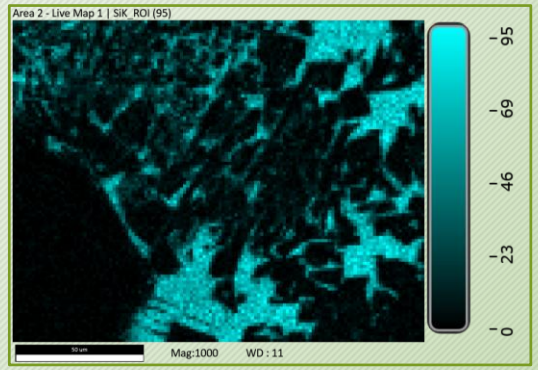
EDS image

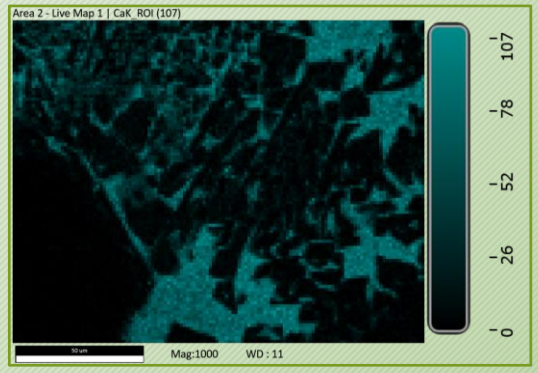


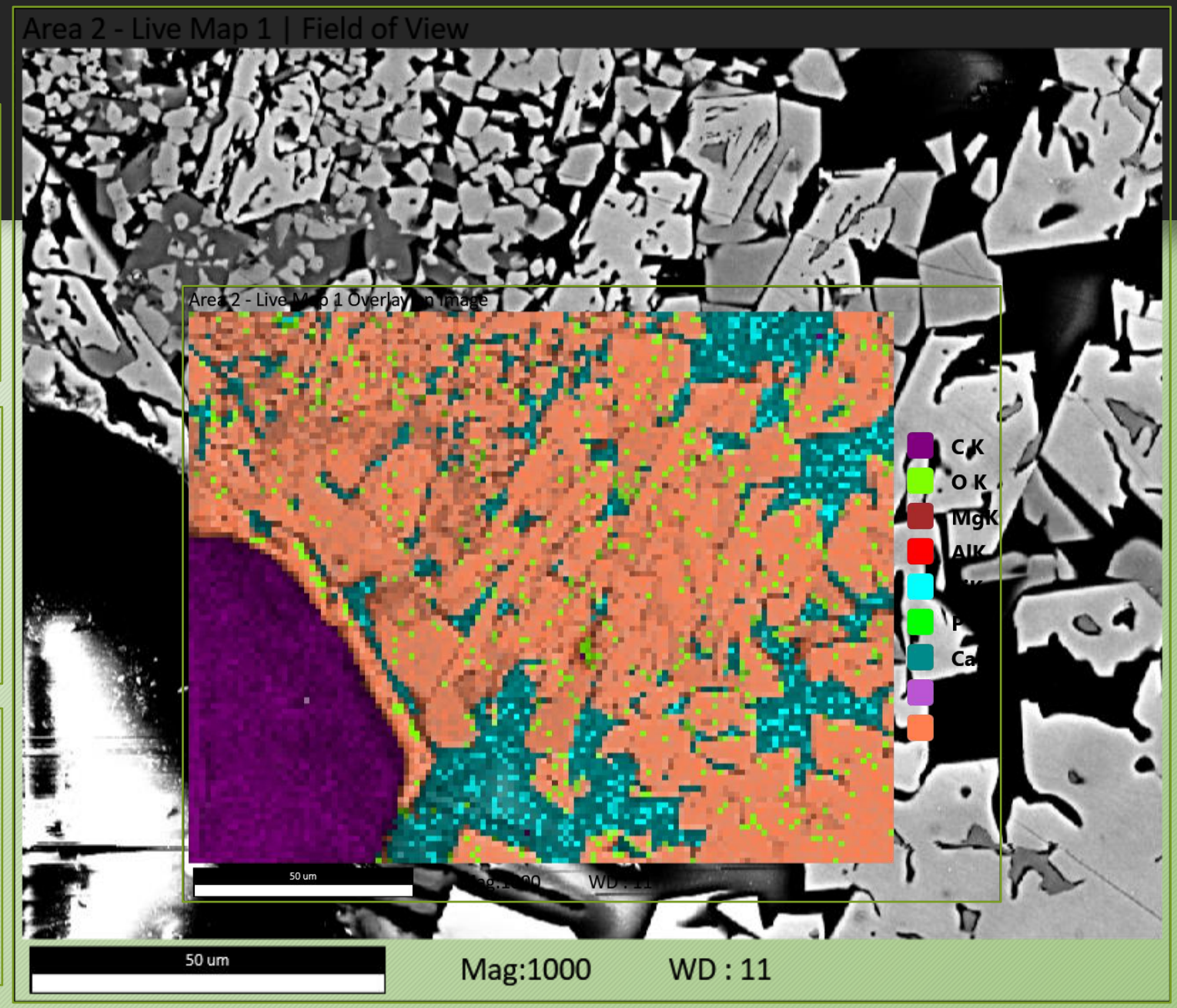
Backscattered image

EDS maps









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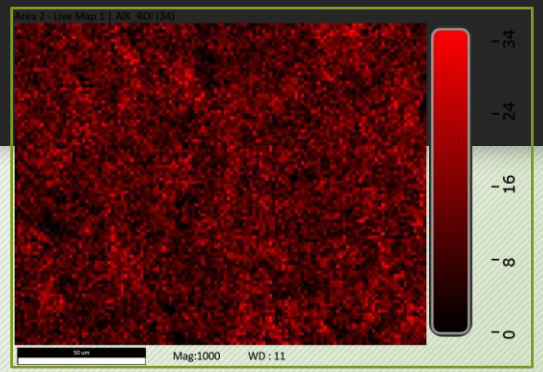

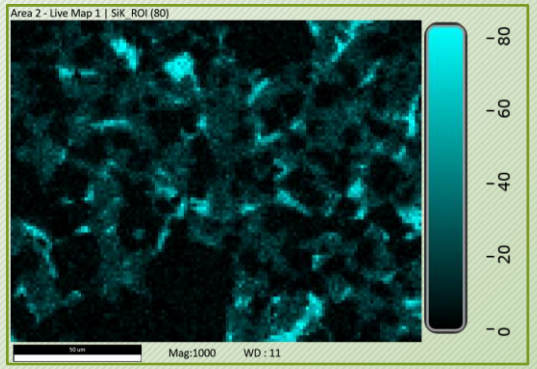

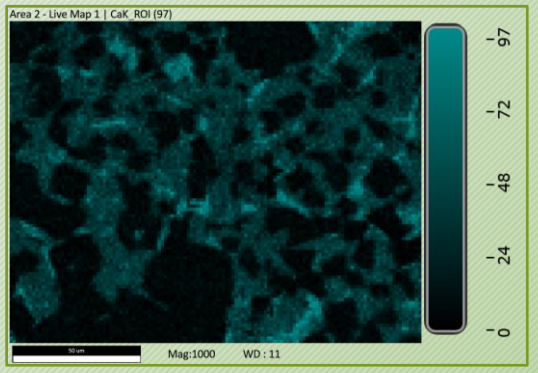

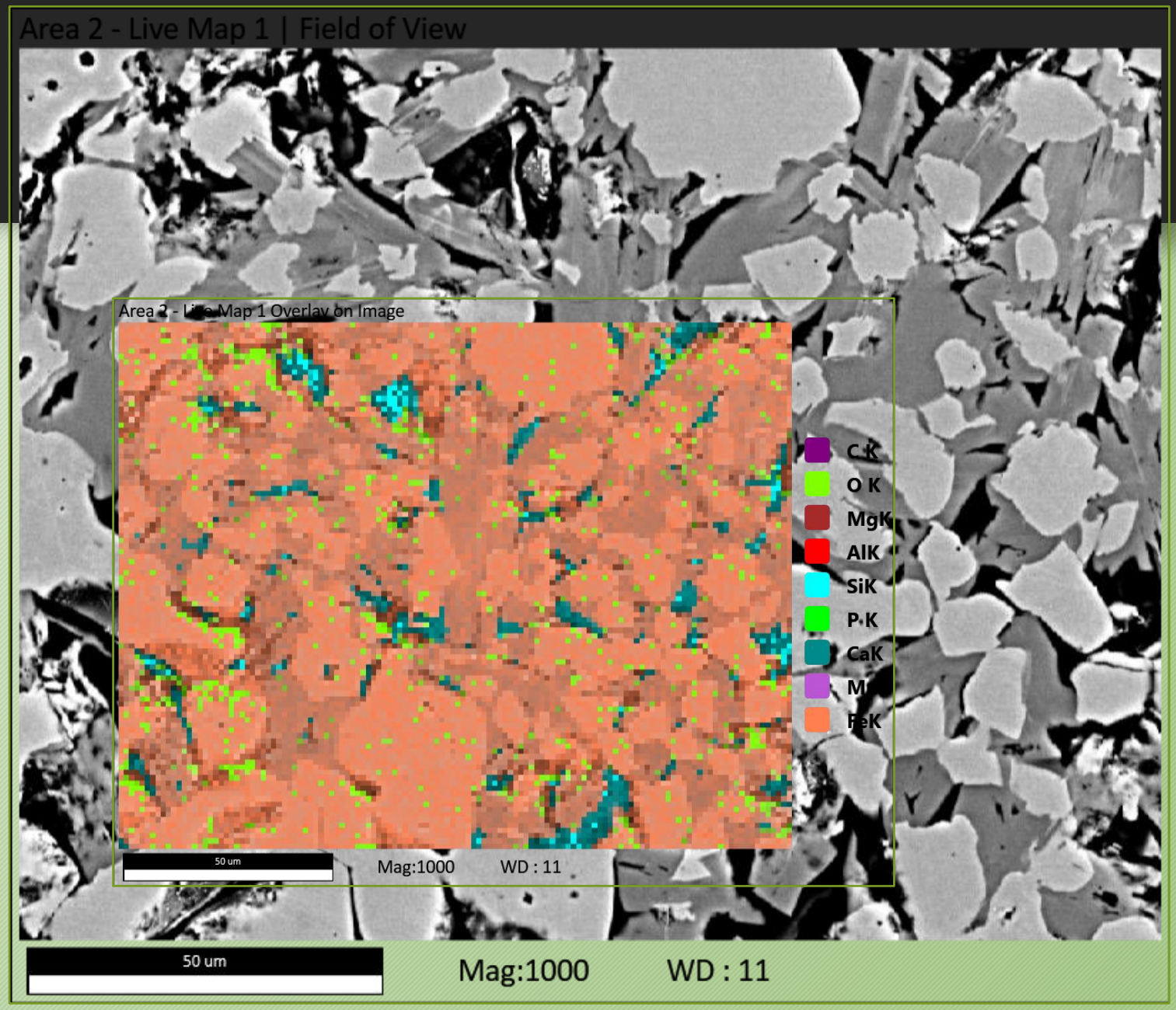

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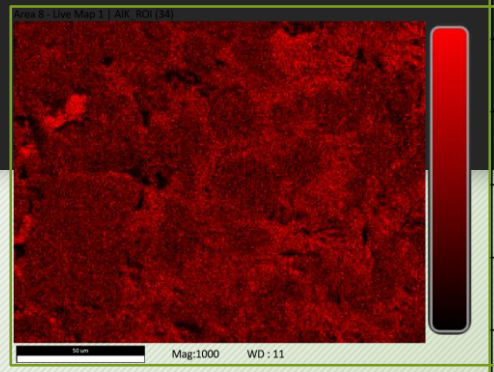
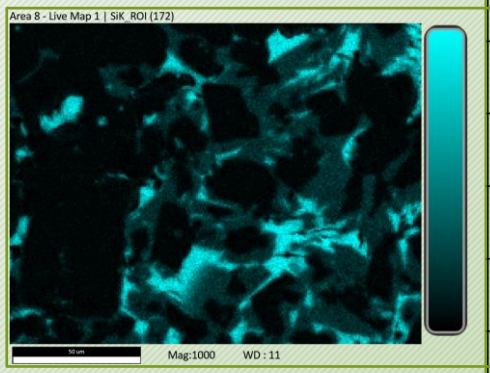
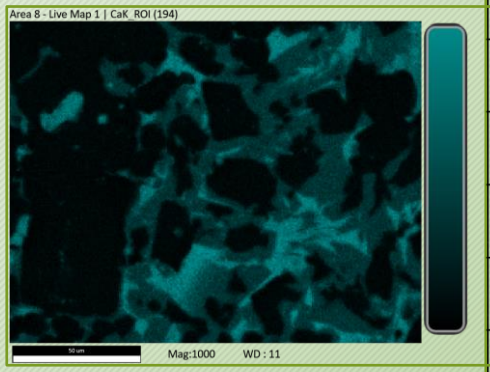
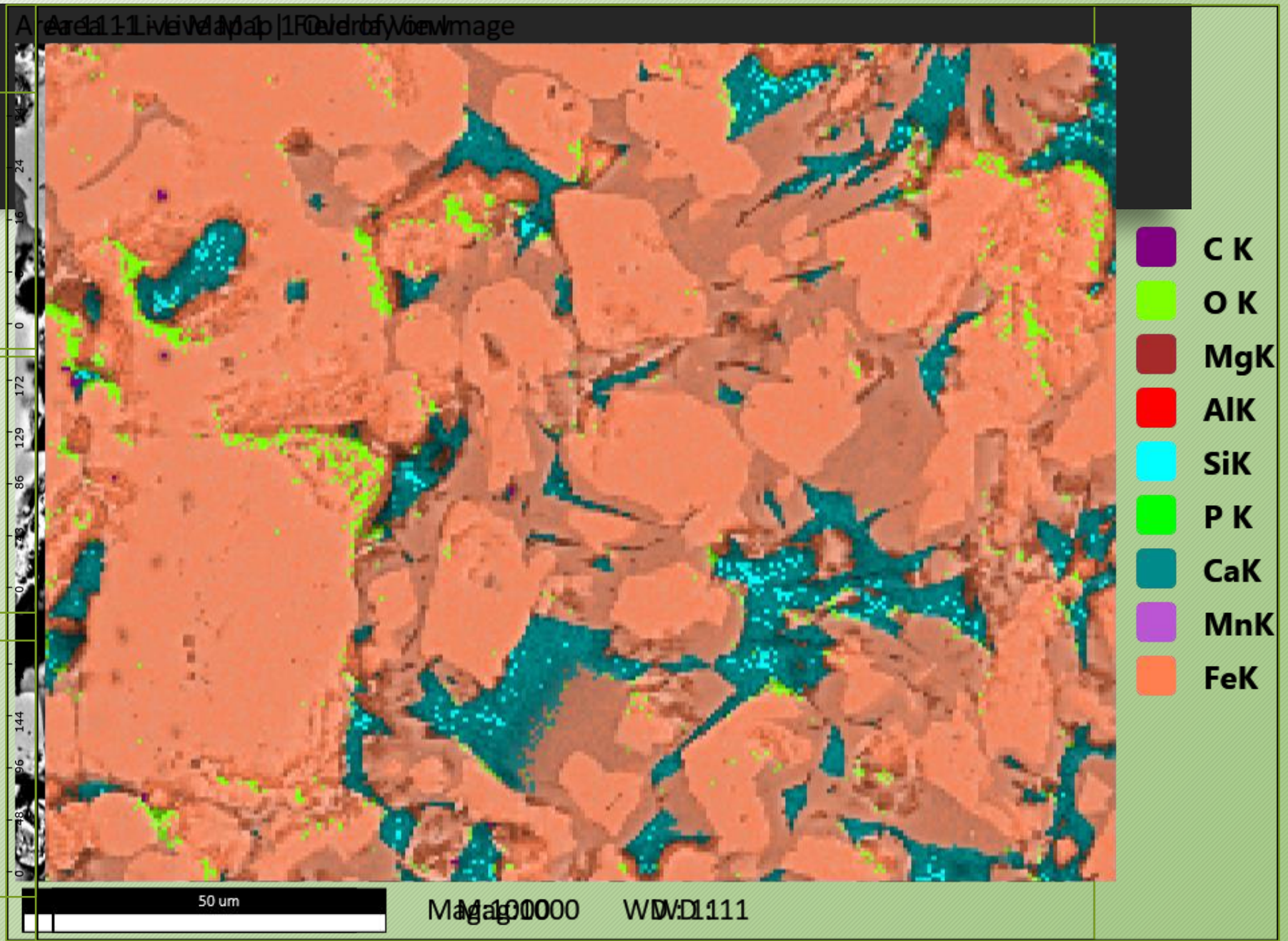


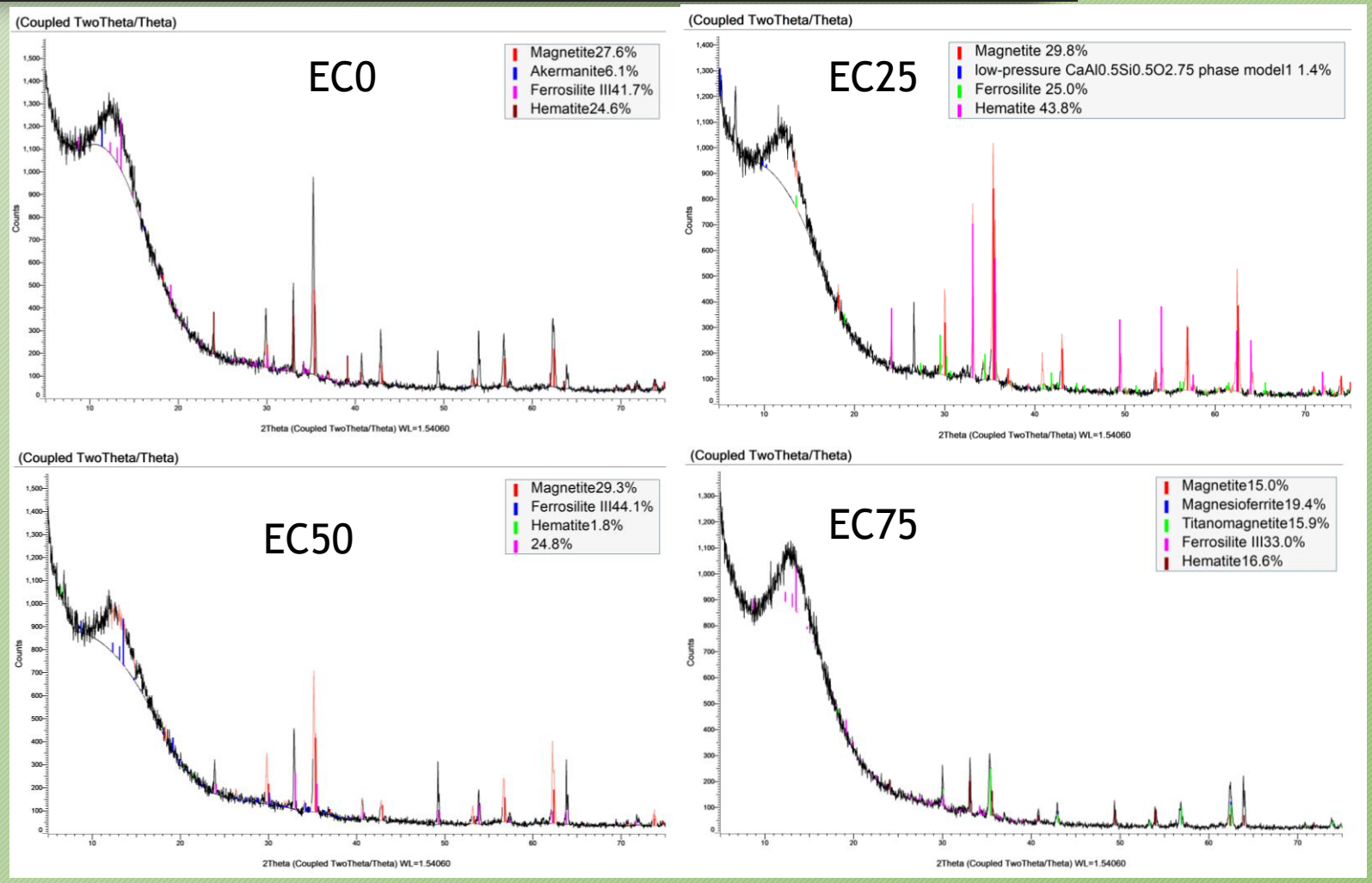






XRD

- XRD scans of 50um crushed sinter
- Show very similar peaks with magnetite and hematite present
- Also present are ferrosilicates



Conclusions

- In lab testing Ecoke® showed that it has a large calorific value due to its high fixed carbon.
- Compared to PT Breeze Ecoke® has a lower activation energy therefore being easier to ignite.
- During sintering trials Ecoke® exceeded temperatures produced by PT breeze and had similar yields
- EDS analysis showed a porous structure with patches of SFCA material
- XRD analysis shows the presence of ferrosilicates but more work to be done increasing resolution and peak identification

Any Questions?

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