

Synthesis of Inorganic Polymers From Vitreous Slags Produced by EAF Smelting of Bauxite Residue

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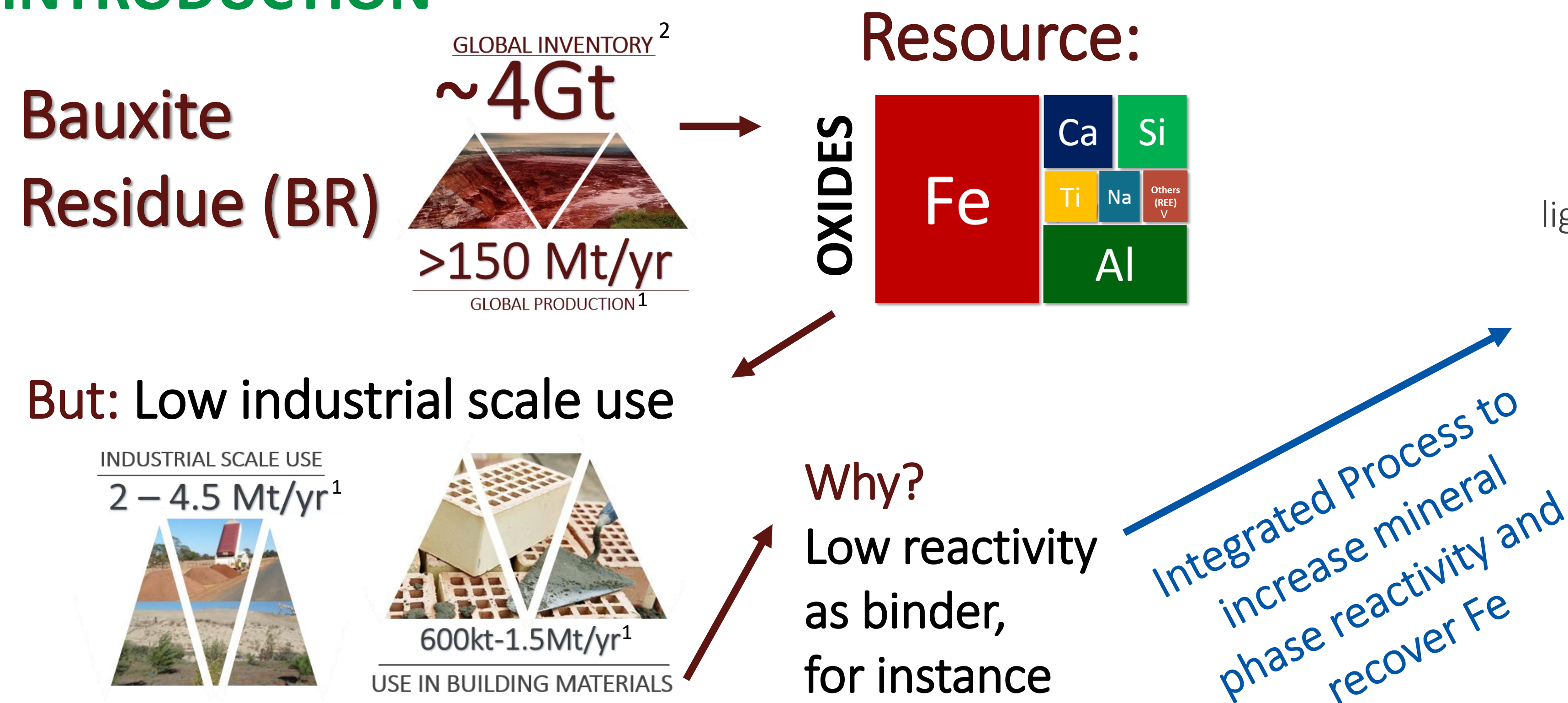
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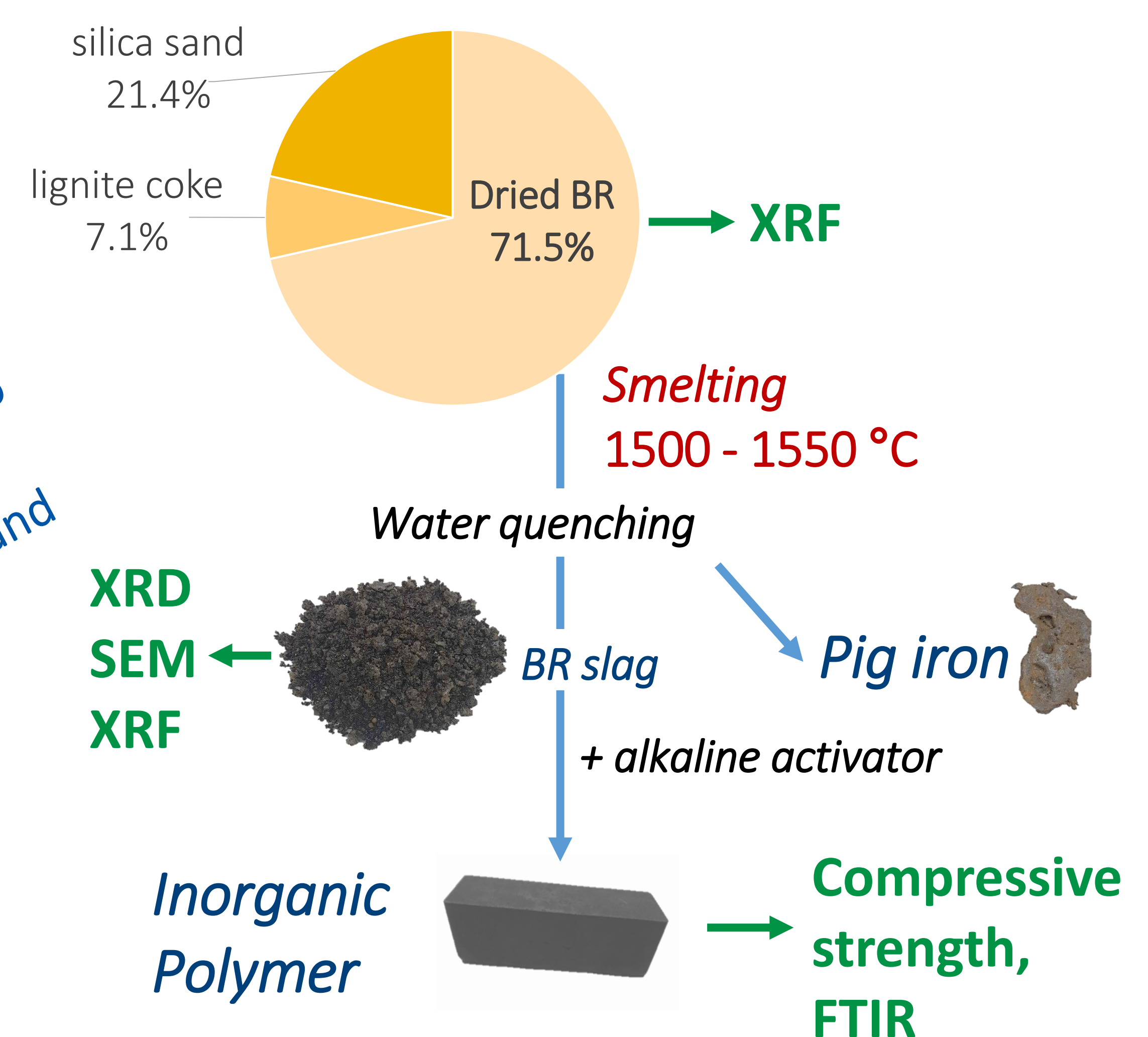
ABSTRACT

In this study, an integrated two-step process is presented for a zero-waste valorisation of BR. In the first step, BR is smelted with additives in an electric arc furnace (EAF) to remove metallic Fe and to produce simultaneously a vitreous slag. The slag produced is activated using an alkaline solution to produce an inorganic polymer. The mechanical properties and microstructure of the final product were then determined.

INTRODUCTION



METHODS AND MATERIALS

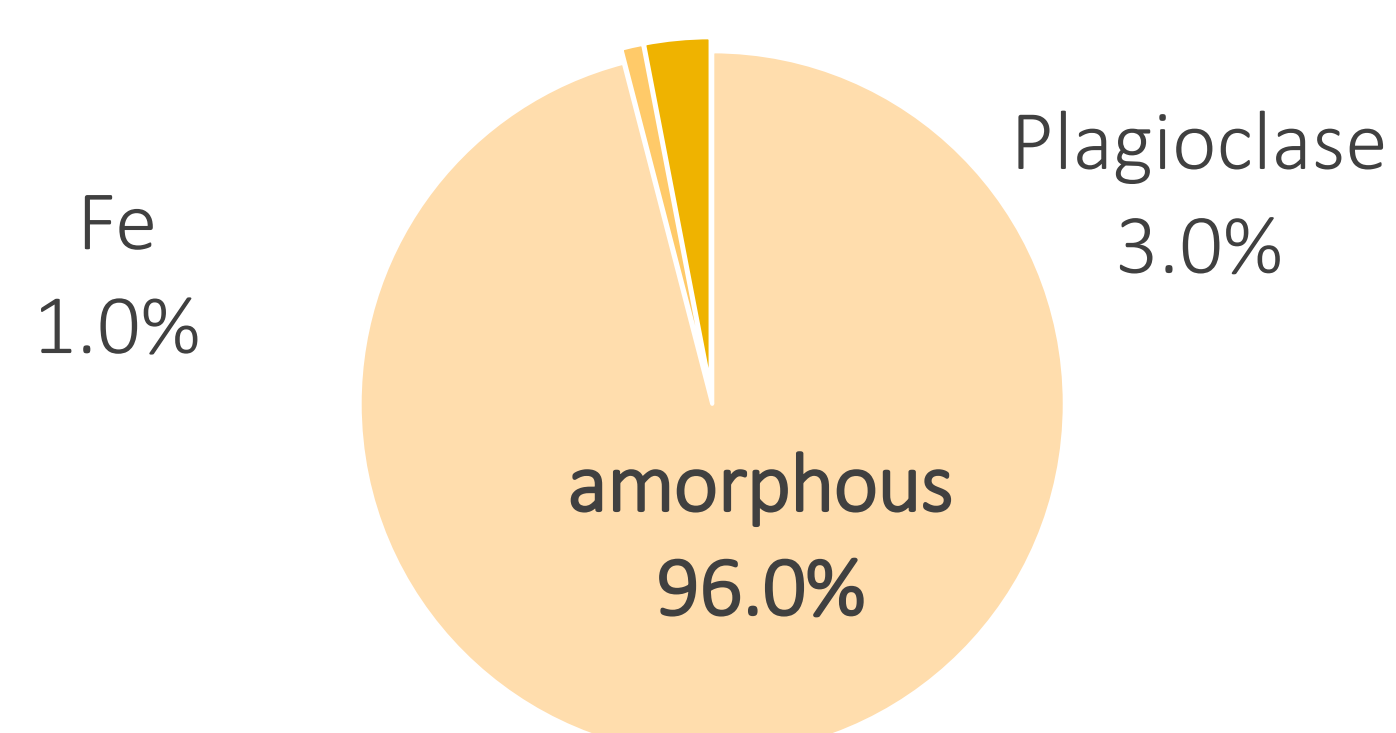


RESULTS

XRF of BR and BR slag:

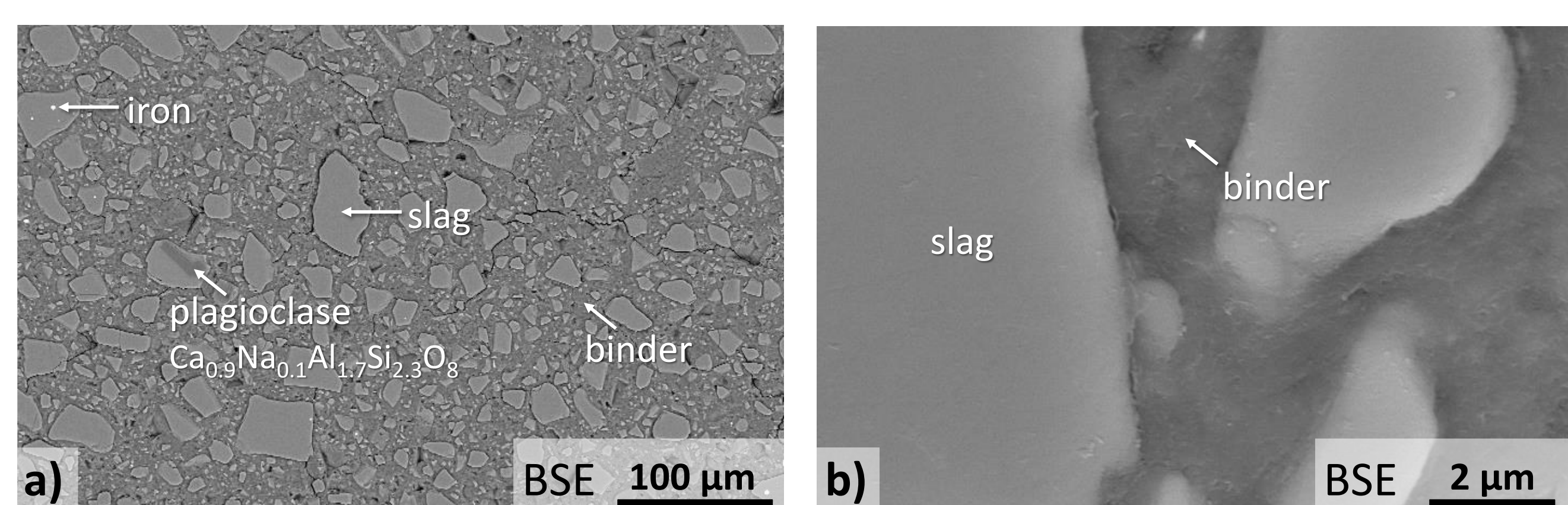
Component (wt%)	Fe	SiO ₂	Al ₂ O ₃	CaO	TiO ₂	Na ₂ O	Others	Loss on ignition	
BR	30.4*	5.5	24.0	10.2	5.6	1.8	0.2	9.4	*expressed as Fe, present as Fe ₂ O ₃ in BR
BR slag	7.0**	39.5	30.3	10.5	7.9	3.2	1.6	-	** expressed as Fe, present as FeO and Fe in BR slag

XRD of BR slag:

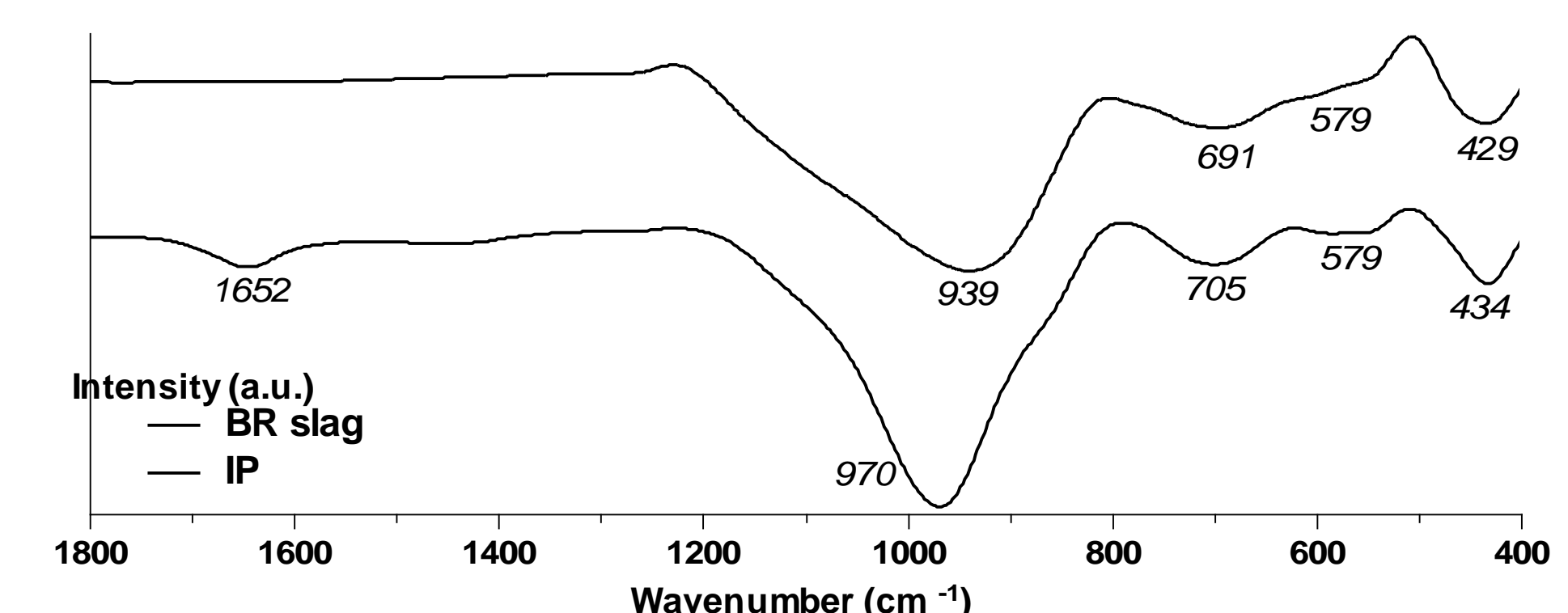


SEM-BSE of Inorganic Polymer:

a) low magnification
b) high magnification



FTIR of Inorganic Polymer:



Compressive Strength of Inorganic Polymer:

76.6 ± 4.8 MPa

CONCLUSIONS

- ✓ Close-to zero-waste valorisation of BR via a two-step process
- ✓ iron removal was achieved through carbothermic reduction in an EAF with a satisfactory recovery of more than 80 %
- ✓ The combination of silica fluxing during the smelting of BR, followed by water quenching of the molten product has shown to favour the formation of a vitrified slag
- ✓ The results demonstrated the high reactivity of the vitreous slag and the formation of a dense IP with satisfactory strength of about 75 MPa

REFERENCES

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