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CERTIFICATE OF ANALYSIS

Certificate Number: 230703 XRF
Company / Organisation:
Client Identification: La Modified Zeolite
AM Identification: AWC-020523-1
AM Request Number: 2300902
Analysis Requested: Oxides by XRF and Bottle Roll Testing

One (1) sample of La modified zeolite, ZF #2, was received on 2 May 2023. The sample was analysed as received.

The sample was fused with 12:22 flux (lithium meta/tetraborate) and the oxide concentrations of the fused solid determined using XRF (Rigaku Primas IV WD XRF), according to ANSTO Minerals controlled document G-5915 XRF Procedures Manual. The XRF results are given in Table 1 (oxides) and Table 2 (elemental) and the following errors apply:

10% for concentrations ≥ 10 times detection limit
20% for concentrations 5 to <10 times detection limit
50% for concentrations 2 to 4 times detection limit
100% for concentrations equal to detection limit

A 5 g sample of material was added to one litre of deionised water and bottle rolled for 12 hours. An aliquot of the leachate was filtered through a 0.45 μm syringe filter assembly and analysed for La and Ce by ICPMS, according to ANSTO Nuclear Science and Technology controlled document I-8143 Agilent Triple Quadrupole ICPMS. The respective measured La and Ce concentrations were 0.0044 ± 0.0004 and 0.0005 ± 0.0001 mg/L¹, which corresponded to 0.0008 % of La and 0.014 % of Ce in the solid reporting to the leachate.

Dr Sue Brown, Senior Radiochemist

Date: 3 July 2023

¹ Limit of reporting was 0.0001 mg/L.

Table 1 – Oxide Concentrations ZF #2 (%)

Oxide	Concentration	DL*	Oxide	Concentration	DL*
Al ₂ O ₃	8.28	0.01	Nd ₂ O ₃	<0.01	0.01
As ₂ O ₃	0.001	0.001	NiO	<0.001	0.001
BaO	0.046	0.001	P ₂ O ₅	0.031	0.001
CaO	1.32	0.001	PbO	0.005	0.001
CeO ₂	0.08	0.01	Pr ₆ O ₁₁	<0.01	0.01
Co ₂ O ₃	<0.001	0.001	Rb ₂ O	<0.001	0.001
Cr ₂ O ₃	<0.001	0.001	SO ₃	0.14	0.001
Cs ₂ O	0.003	0.001	Sc ₂ O ₃	<0.001	0.001
CuO	<0.001	0.001	SiO ₂	60.5	0.01
Dy ₂ O ₃	<0.01	0.01	Sm ₂ O ₃	<0.01	0.01
Er ₂ O ₃	<0.01	0.01	SnO ₂	0.001	0.001
Eu ₂ O ₃	<0.01	0.01	SrO	0.017	0.001
Fe ₂ O ₃	1.05	0.001	Ta ₂ O ₅	0.004	0.001
Gd ₂ O ₃	<0.01	0.01	Tb ₄ O ₇	<0.01	0.01
HfO ₂	0.002	0.001	ThO ₂	0.001	0.001
Ho ₂ O ₃	<0.01	0.01	TiO ₂	0.13	0.001
K ₂ O	1.96	0.001	Tm ₂ O ₃	<0.01	0.01
La ₂ O ₃	12.7	0.01	U ₃ O ₈	0.001	0.001
Lu ₂ O ₃	<0.01	0.01	V ₂ O ₅	0.003	0.001
MgO	0.38	0.01	Y ₂ O ₃	0.005	0.001
MnO	0.071	0.001	Yb ₂ O ₃	<0.01	0.01
MoO ₃	0.002	0.001	ZnO	0.011	0.001
Na ₂ O	1.67	0.05	ZrO ₂	0.020	0.001
Nb ₂ O ₅	0.004	0.001	LOI ^a	11.5	

* Detection limit.

^a From XRF.

Table 1 – Elemental Concentrations ZF #2 (%)

Element	Concentration	DL*	Oxide	Concentration	DL*
Al	4.38	0.01	Nd	<0.01	0.01
As	0.001	0.001	Ni	<0.001	0.001
Ba	0.041	0.001	P	0.014	0.001
Ca	0.95	0.001	Pb	0.005	0.001
Ce	0.07	0.01	Pr	<0.01	0.01
Co	<0.001	0.001	Rb	<0.001	0.001
Cr	<0.001	0.001	S	0.06	0.001
Cs	0.003	0.001	Sc	<0.001	0.001
Cu	<0.001	0.001	Si	28.3	0.01
Dy	<0.01	0.01	Sm	<0.01	0.01
Er	<0.01	0.01	Sn	0.001	0.001
Eu	<0.01	0.01	Sr	0.014	0.001
Fe	0.74	0.001	Ta	0.003	0.001
Gd	<0.01	0.01	Tb	<0.01	0.01
Hf	0.002	0.001	Th	0.001	0.001
Ho	<0.01	0.01	Ti	0.08	0.001
K	1.63	0.001	Tm	<0.01	0.01
La	10.8	0.01	U	0.001	0.001
Lu	<0.01	0.01	V	0.002	0.001
Mg	0.23	0.01	Y	0.004	0.001
Mn	0.055	0.001	Yb	<0.01	0.01
Mo	0.001	0.001	Zn	0.009	0.001
Na	1.24	0.05	Zr	0.015	0.001
Nb	0.003	0.001	LOI [^]	11.5	

* Detection limit.

[^] From XRF.