

**Supplementary**
**Table A. Standardless SEM analysis of microprobe standards.**

<b>Fe<sub>2</sub>O<sub>3</sub></b>								<b>Rutile</b>							
Element	k Ratio	Mass %	St dev	Atom %	Std Mass %	Difference	% Diff	Element	k Ratio	Mass %	St dev	Atom %	Std Mass %	Difference	% Diff
O	0.11279	29.24	0.46	59.05	30.06	-0.82	-3	O	0.0396	40.97	0.8	67.51	40.05	0.92	2
Fe	0.36553	70.76	0.46	40.95	69.94	0.82	1	Ti	0.3514	59.03	0.8	32.49	59.95	-0.92	-2
Total:		100		100				Total:		100		100			
<b>Cr<sub>2</sub>O<sub>3</sub></b>								<b>MgO</b>							
Element	k Ratio	Mass %	St dev	Atom %	Std Mass %	Difference	% Diff	Element	k Ratio	Mass %	St dev	Atom %	Std Mass %	Difference	% Diff
O	0.14046	32.66	0.41	61.19	31.58	1.08	3	O	0.09198	38.02	0.37	48.24	39.7	-1.68	-4
Cr	0.33735	67.34	0.41	38.81	68.42	-1.08	-2	Mg	0.20483	61.98	0.37	51.76	60.3	1.68	3
Total:		100		100				Total:		100		100			
<b>Rhodonite</b>								<b>Orthoclase</b>							
Element	k Ratio	Mass %	St dev	Atom %	Std Mass %	Difference	% Diff	Element	k Ratio	Mass %	St dev	Atom %	Std Mass %	Difference	% Diff
O	0.09954	38.63	0.49	60.51	37.77	0.86	2	O	0.0815	46.27	0.46	61.43	46.47	-0.2	0
Mg	0.00403	1.33	0.13	1.37	1.12	0.21	19	Na	0.00278	1.02	0.12	0.95	1.01	0.01	1
Si	0.09762	22.62	0.33	20.18	22.11	0.51	2	Al	0.04005	9.99	0.21	7.86	9.81	0.18	2
Ca	0.02689	5.09	0.2	3.19	5.1	-0.01	0	Si	0.12658	30.8	0.35	23.29	30.4	0.4	1
Mn	0.15333	32.33	0.55	14.75	32.85	-0.52	-2	K	0.05287	11.92	0.27	6.47	12.18	-0.26	-2
Total:		100		100				Total:		100		100			

Table B. Formula calculation of Spinel A in sample CMD0.

Cr-spinel Formula Calculation									
Oxide	Percent	Mol Mass	Mole Prop	No Cations	Cations to 3	Oxygens to 4	Cations recalc	Oxides Recalc	Recalc %
TiO <sub>2</sub>	0.12625	79.88	0.0016	0.0016	0.0028	0.0056	0.0028	0.0015805	0.13
Al <sub>2</sub> O <sub>3</sub>	9.26375	101.96	0.0909	0.1817	0.3245	0.4867	0.3245	0.09085671	9.26
Cr <sub>2</sub> O <sub>3</sub>	26.76375	151.99	0.1761	0.3522	0.6289	0.9433	0.6289	0.17608889	26.76
Fe <sub>2</sub> O <sub>3</sub>	35.77688	159.69	0.2240	0.4481	0.8001		1.0410	0.29149952	46.55
FeO		71.85			0.0000	1.3206	-0.2409	-0.13491995	-9.69
MgO	28.07	40.3	0.6965	0.6965	1.2437	1.2437	1.2437	0.69652605	28.07
Total	100.00			1.6801	3.0000	4.0000	3.0000		101.08
				xFe <sup>2+</sup> + yFe <sup>3+</sup> =		0.8001			
				xFe <sup>2+</sup> + 1.5yFe <sup>3+</sup> =		1.3206	Determined by difference		
				0.5yFe <sup>3+</sup> =		0.5205			
				Fe <sup>3+</sup> =		1.0410			

Table C. Comparison between bulk compositions calculated from XRD and EDS analysis and ICP analysis.

	SiO <sub>2</sub>	CaO	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Cr <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MgO
<b>CMD0</b>							
Calc Analysis	3.84	1.42	0.28	11.58	26.93	13.18	42.91
ICP Analysis	2.34	0.77	0.28	9.65	26.40	12.60	44.65
<b>CMD1</b>							
Calc Analysis	3.11	1.34	2.61	8.34	23.31	15.80	45.50
ICP Analysis	2.31	0.89	1.21	8.72	25.79	12.11	45.55
<b>CMD3</b>							
Calc Analysis	2.10	0.77	5.24	8.01	22.97	16.63	44.30
ICP Analysis	1.81	0.65	3.88	8.03	23.45	12.35	45.35
<b>CMD5</b>							
Calc Analysis	2.44	0.92	8.56	9.22	23.22	12.18	43.49
ICP Analysis	2.05	0.79	4.88	8.40	23.89	11.67	45.25
<b>CMD7</b>							
Calc Analysis	3.86	1.09	4.70	7.98	23.69	15.72	42.99
ICP Analysis	2.93	0.99	6.87	8.48	22.33	12.03	44.00

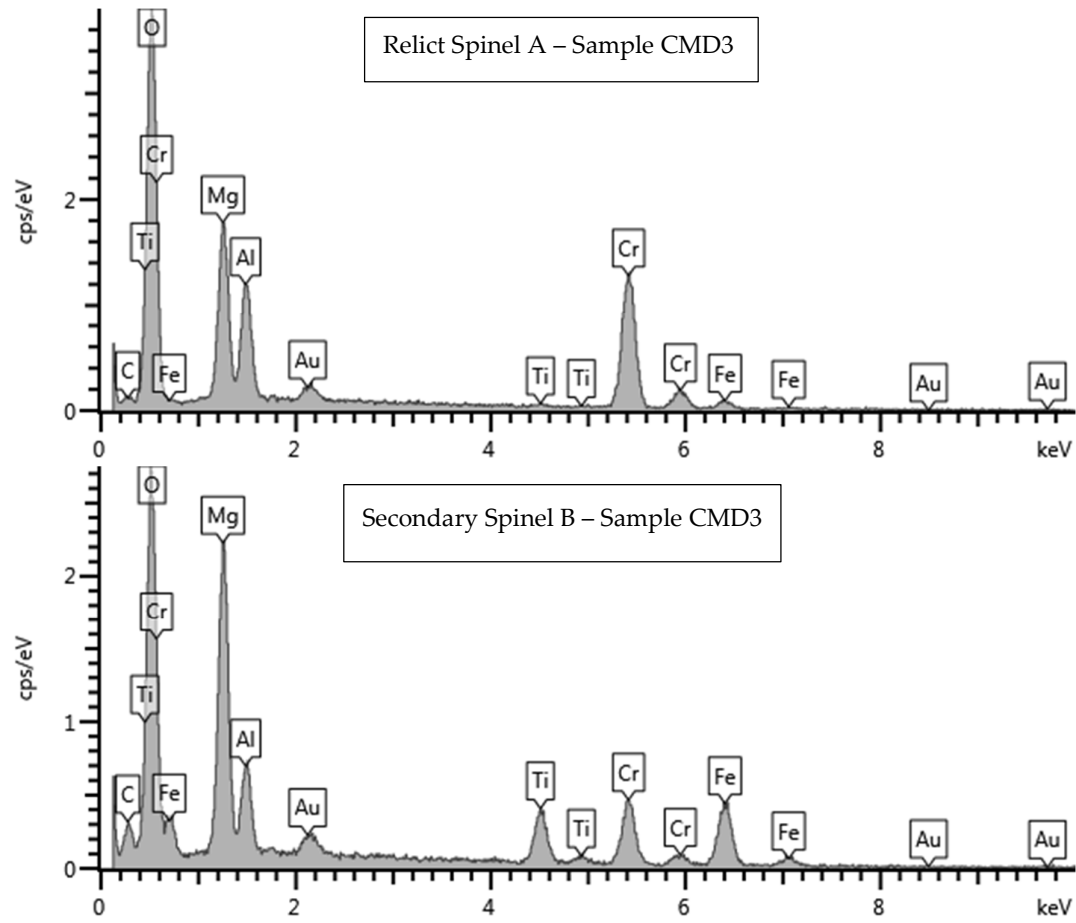
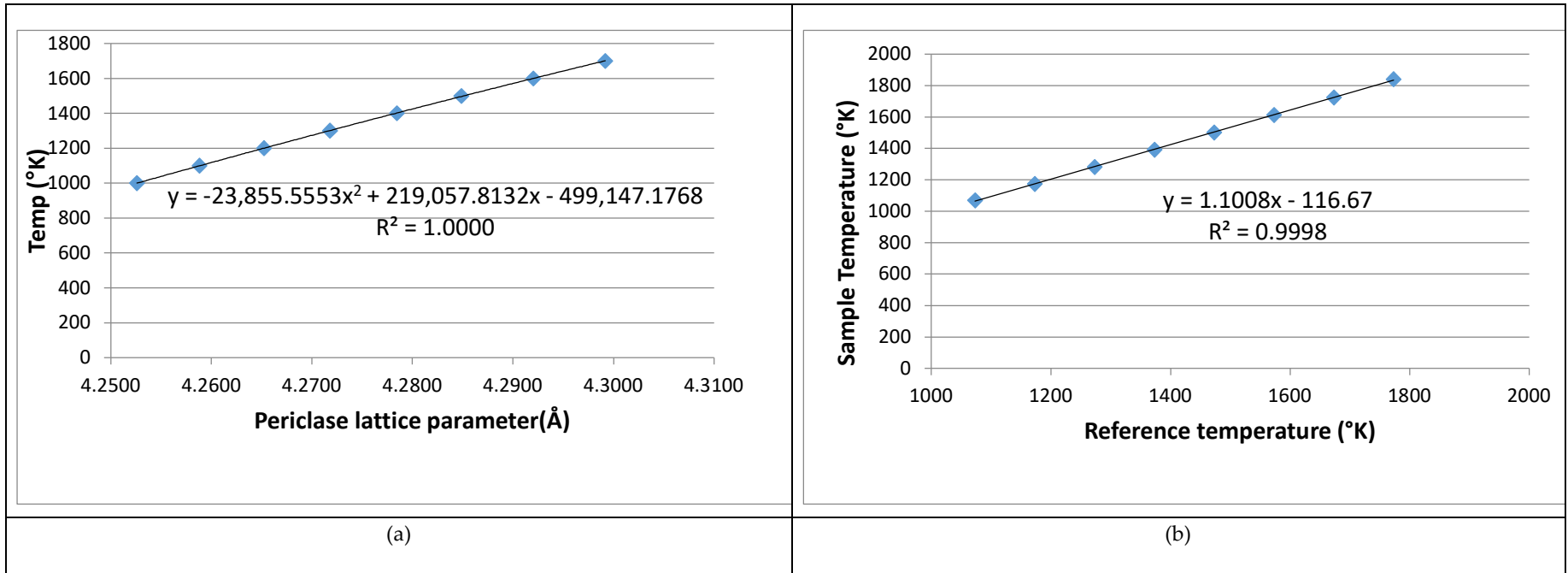
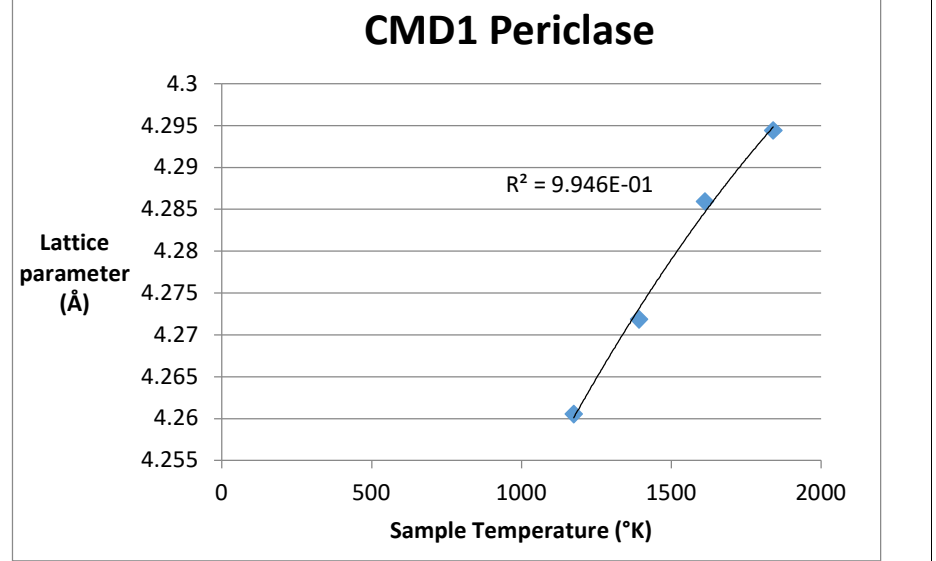
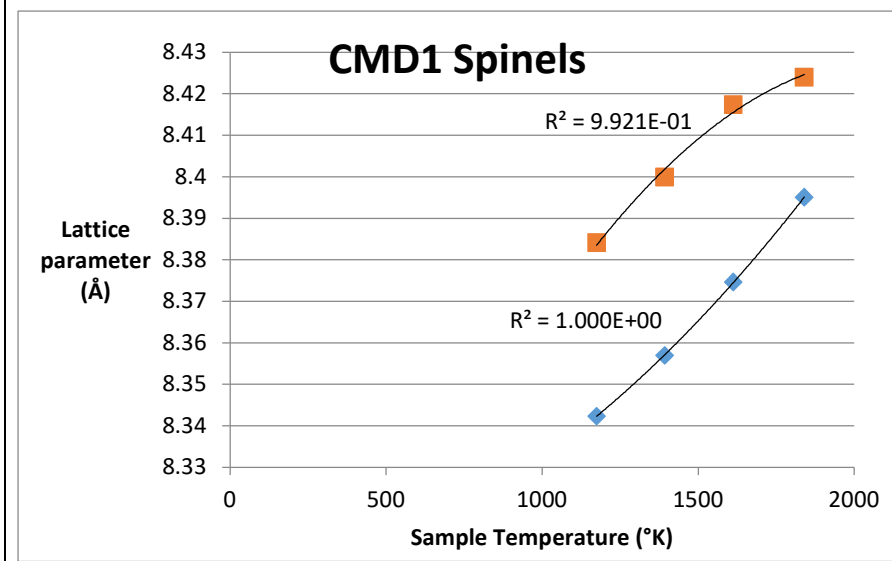
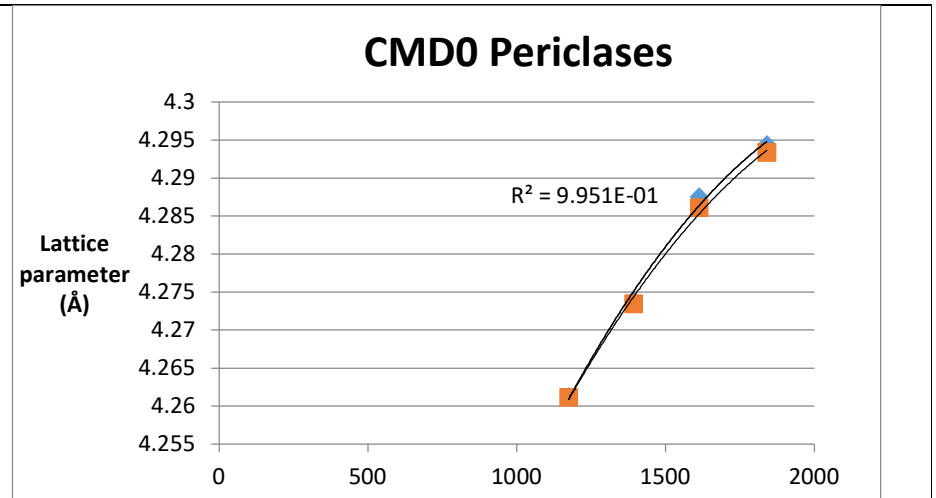
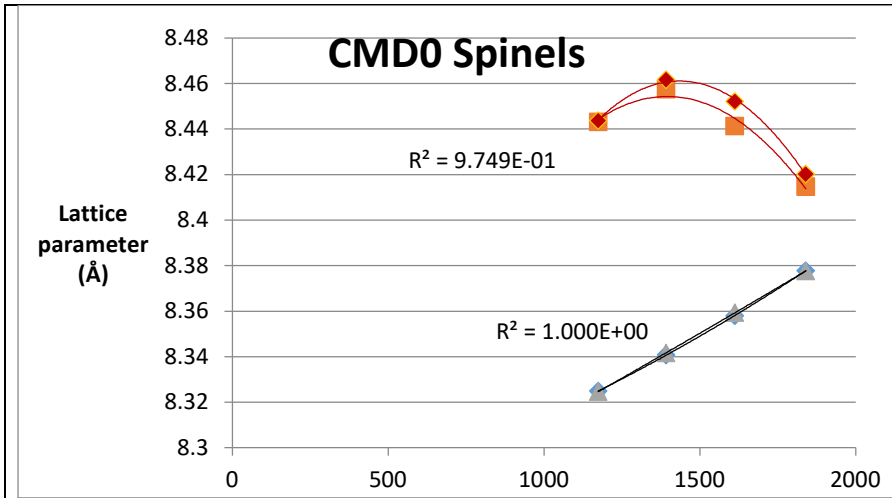
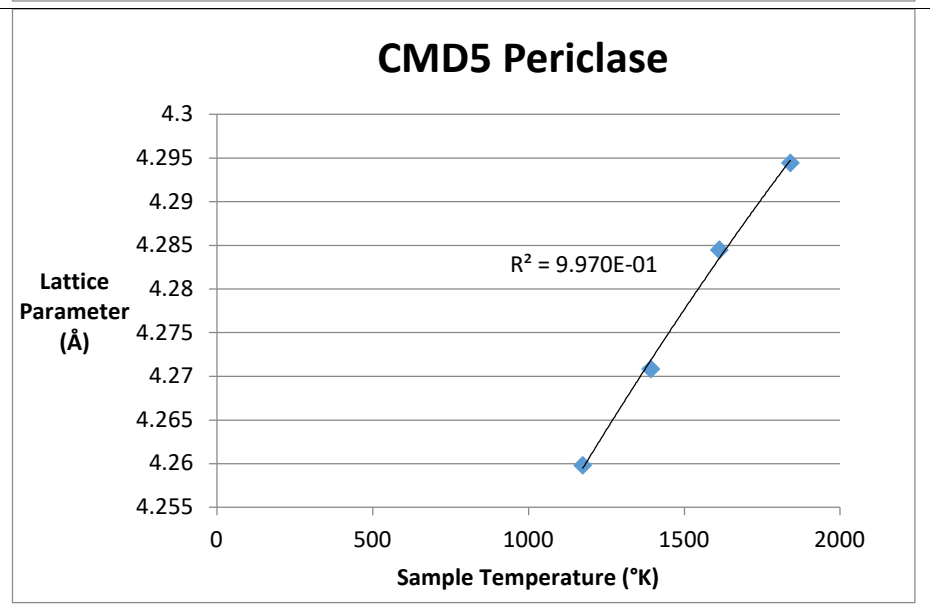
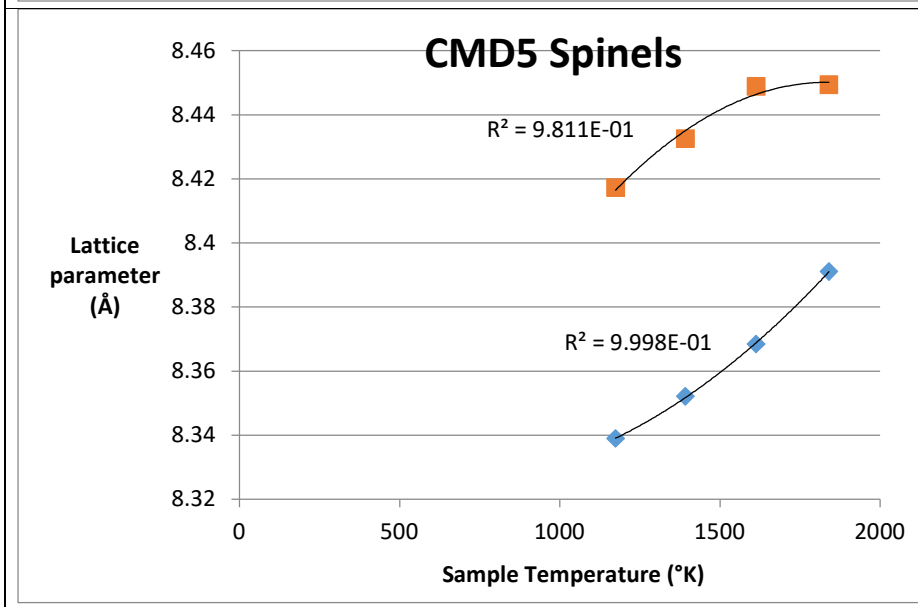
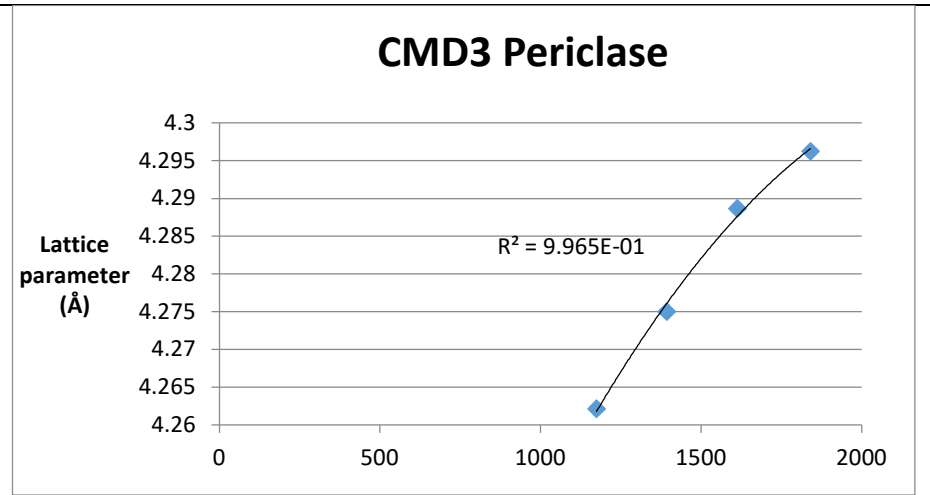
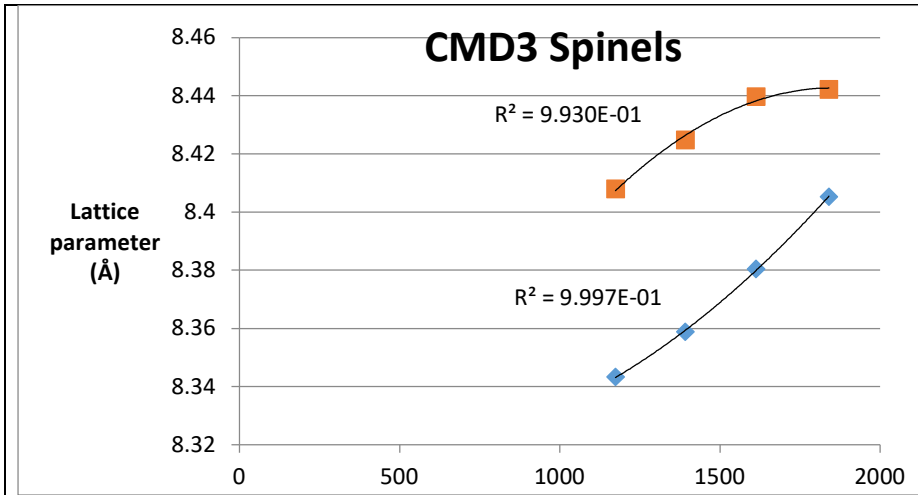


Figure A. EDS spectra of Spinel A (top) and spinel B (bottom) from sample CMD3.



**Figure B.** (a) Variation of the periclase lattice parameter with temperature from the data of Toloukian et al [21] and (b) the corrected sample temperature as calibrated from high temperature XRD data of MgO.





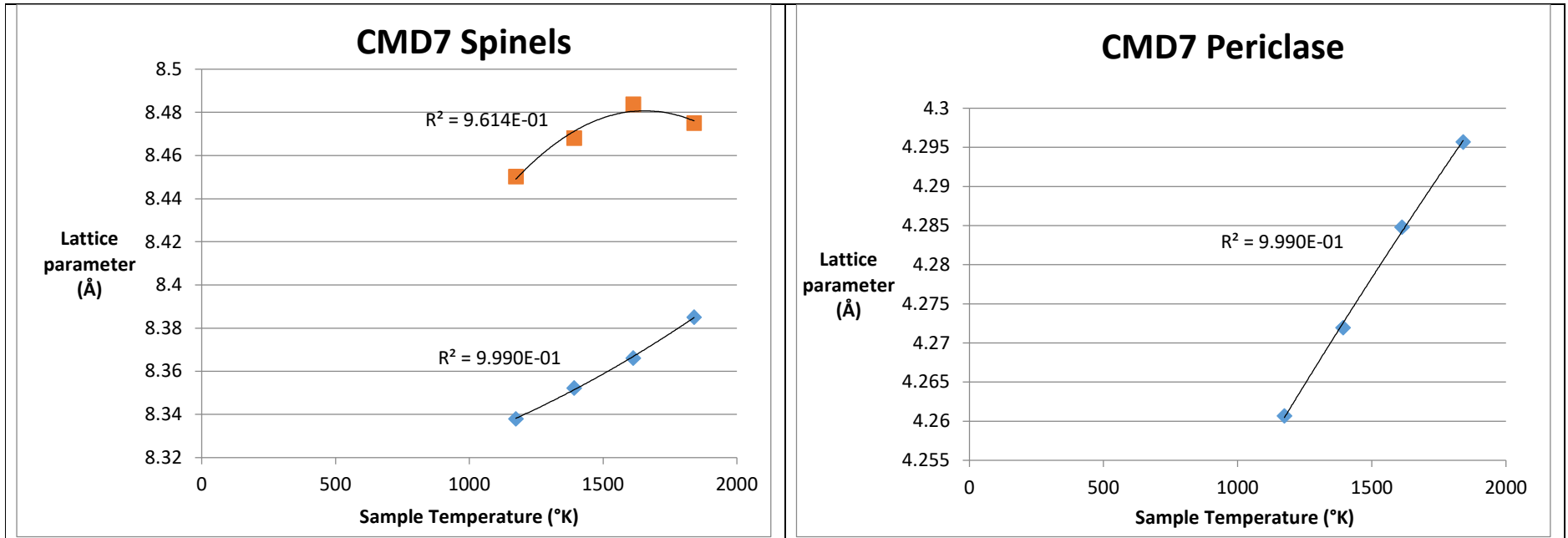


Figure C. Thermal expansion data for CMD samples. All diagrams show lattice constant as a function of temperature in degrees Kelvin.



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