LIST OF FIGURES

Figure No.		Page
2.1	Equilibrium diagram for the join forsterite-anorthite	17
2.2	XRD traces of forsterite prepared by reacting $MgCO_3$ & talc after different mechanical activation duration & annealing at 1000°C for 1 hour	22
2.3	XRD traces of forsterite prepared by reacting $MgCO_3$ & talc after different mechanical activation duration & annealing at 1000°C for 1 hour	23
2.4	XRD traces forsterite prepared by reacting MgO & talc after different mechanical activation duration & annealing at 1000°C for 1 hour	24
2.5	XRD traces of spray-dried precursor powder of Mg_2SiO_4 heated at different temperatures	25
2.6	XRD traces of evaporated precursor powder of Mg_2SiO_4 heated at different temperatures	26
2.7	XRD traces forsterite prepared by reacting $MgCO_3$ & talc after different mechanical activation duration without heat treatment	29
2.8	XRD traces of forsterite prepared by reacting $MgCO_3$ & talc after different mechanical activation duration & annealing at 1000°C for 1 hour	30
2.9	XRD traces of forsterite prepared by reacting $MgCO_3$ & talc after different mechanical activation duration & annealing at 1200°C for 1 hour	31
2.10	XRD traces of forsterite prepared by reacting $MgCO_3$ & talc after mechanical activation for 5 hours & heat treatment for 10 minutes	32
2.11	XRD traces of forsterite prepared by reacting $MgCO_3$ & talc After mechanical activation for 10 hours & heat treatment for 10 minutes	32
2.12	XRD traces of forsterite prepared by reacting MgO & talc after various mechanical activation duration without heat treatment	34

2.13	XRD traces of forsterite prepared by reacting MgO & talc after various mechanical activation duration and heat treatment at 1000°C for 1 hour	35
2.14	XRD traces of forsterite prepared by reacting MgO & talc after various mechanical activation duration and heat treatment at 1200°C for 1 hour	35
2.15	XRD traces of forsterite prepared by reacting MgO & talc after various mechanical activation duration without heat treatment	36
2.16	XRD traces of forsterite prepared by reacting MgO & talc after various mechanical activation duration & heat treatment at 1000°C for 1 hour	37
2.17	XRD traces of forsterite prepared by reacting MgO & talc after various mechanical activation duration & heat treatment at 1200°C for 1 hour	38
2.18	XRD traces of forsterite ceramic sintered at 1450°C and 1550°C for 8 hours	39
2.19	Effect of sintering temperature on relative density for sintered forsterite ceramic at various temperature for 8 hours	40
2.20	SEM monograph of forsterite ceramic fracture surface after sintering at 1450°C for 8 hours	41
2.21	SEM monograph of forsterite ceramic fracture surface after sintering at 1550°C for 8 hours	42
2.22	Effect of sintering temperature on relative density for sintered forsterite ceramic at various temperature for 2 hours	43
2.23	Effect of sintering temperature on fracture toughness for sintered forsterite ceramic at various temperature for 2 hours	44
2.24	Effect of sintering temperature on Vickers hardness for sintered forsterite ceramic at various temperature for 2 hours	44
2.25	Relative density of the sintered samples as a function of $T1$ and grain size after second step sintering temperature at 750°C	46

2.26	Relative density of the sintered samples as a function of $T1$ and grain size after second step sintering temperature at 850°C	46
2.27	Fracture toughness of forsterite bulk as a function of $T1$ after second step sintering temperatures at 750°C & 850°C	48
2.28	Vickers microhardness of forsterite bulk as a function of $T1$ after second step sintering temperatures at 750°C & 850°C	48
3.1	Schematic diagram of indentation on forsterite compact	59
3.2	Definition for scores based on number of intersections	64
4.1	XRD traces of synthesized forsterite powder before sintering	66
4.2	XRD traces of forsterite powder subject to 2 hours direct ultrasonication with 30% amplitude and 2 hours heat treatment at 1200˚C	67
4.3	XRD traces of forsterite powder subject to 2 hours direct ultrasonication with 50% amplitude and 2 hours heat treatment at 1200˚C	68
4.4	XRD traces of forsterite powder after direct ultrasonication with 30% amplitude and ball milling at various time after heat treatment	69
4.5	XRD traces of forsterite powder after direct ultrasonication with 50% amplitude and ball milling at various time after heat treatment	70
4.6	XRD traces of forsterite powder after direct ultrasonication with 50% amplitude, 3 hours ball milling and heat treatment 1250°C for 2 hours	71
4.7	XRD traces of forsterite powder after 3 hours ball milling and heat treatment (1200°C & 1250°C) for 2 hours	72
4.8	XRD traces of forsterite powder after ultrasonic bath, 3 hours ball milling and heat treatment at different temperature for 1 hour	73
4.9	XRD traces of forsterite powder after 3 hours ball milling and 1 hour heat treatment at 1400°C with different holding time	74

4.10	XRD traces sample set no.1 (3 hours ball milling and 1 hour heat treatment) after sintering at different temperatures (1200°C to 1500°C)	76
4.11	XRD traces sample set no.2 (3 hours ball milling and no heat treatment) after sintering at different temperatures (1200°C to 1500°C)	77
4.12	XRD traces of sintered forsterite compacts with 1200°C for 2 hours at 10°C/min	78
4.13	XRD traces of sintered forsterite compacts with 1300°C for 2 hours at 10°C/min	79
4.14	XRD traces of sintered forsterite compacts with 1400°C for 2 hours at 10°C/min	80
4.15	XRD traces of sintered forsterite compacts with 1500°C for 2 hours at 10°C/min	80
4.16	XRD traces of sintered forsterite compacts with 1200°C for 1 hours at 10°C/min	81
4.17	XRD traces of sintered forsterite compacts with 1300°C for 1 hours at 10°C/min	82
4.18	XRD traces of sintered forsterite compacts with 1400°C for 1 hours at 10°C/min	82
4.19	XRD traces of sintered forsterite compacts with 1500°C for 1 hours at 10°C/min	83
4.20	XRD traces of sintered forsterite compacts with 1200°C for 1 minute at 10°C/min	83
4.21	XRD traces of sintered forsterite compacts with 1300°C for 1 minute at 10°C/min	84
4.22	XRD traces of sintered forsterite compacts with 1400°C for 1 minute at 10°C/min	85
4.23	XRD traces of sintered forsterite compacts with 1500°C for 1 minute at 10°C/min	85
4.24	Crystallite size of forsterite produced with different sintering temperatures and holding times	86

4.25	The effect of sintering temperatures and holding times on forsterite volume shrinkage	89
4.26	The effect of sintering temperatures and holding times on forsterite relative bulk density	91
4.27	Diamond shaped Vickers indentation of forsterite sample sintered at 1200°C, 1300°C, 1400°C and 1500°C with 1 hour holding time	92
4.28	Diamond shaped Vickers indentation of forsterite sample sintered at 1500°C with 3 different holding times; (a) 2 hours, (b) 1 hour, (c) 1 minute	93
4.29	The effect of sintering temperature and holding time on Vickers hardness of forsterite samples	94
4.30	The effect of relative density on Vickers hardness with different sintering temperature and holding time	94
4.31	The effect of sintering temperatures and holding times on fracture toughness of forsterite compacts	95
4.32	The effect of relative density on fracture toughness with Different sintering temperature and holding time	97
4.33	The effect of different sintering temperatures and holding Times on Young's Modulus of forsterite	98
4.34	FESEM micrographs of forsterite powder prepared by 22 minutes ultrasonification and 3 hours ball milling	99
4.35	FESEM micrographs of forsterite compacts sintered at 1200°C, 1300°C, 1400°C and 1500°C with 2 hours holding time (Group 1)	100
4.36	FESEM micrographs of forsterite compacts sintered at 1200°C, 1300°C, 1400°C and 1500°C with 1 hours holding time (Group 2)	101
4.37	FESEM micrographs of forsterite compacts sintered at 1200°C, 1300°C, 1400°C and 1500°C with 1 minute holding time (Group 3)	102

4.38	FESEM micrographs of sintered forsterite compacts Sintered at 1200°C, 1300°C, 1400°C &1500°C with 3 different holding times; (a) 2 hours (Group 1), (b) 1 hour (Group 2), (c) 1 minute (Group 3)	104
4.39	FESEM micrographs of cracked surface resulting from quenching after sintered at 1000°C, 1200°C, 1400°C, 1500°C with ramp rate of 10°C/min	105
4.40	Closed up FESEM micrographs of forsterite compact sintered at 1500°C	106
4.41	The effect of sintering temperature with three different holding times (Group1: 2 hours, Group 2: 1 hour and Group 3: 1 minute) on grain size of sintered forsterite Compacts	107
4.42	The effect of relative density on grain size of sinterered forsterite	107
4.43	The effect of Vickers hardness on grain size of sinterered forsterite	108
4.44	The effect of fracture toughness on grain size of sinterered forsterite	109