

**Table 1. Experimental conditions<sup>1</sup> and results of angle measurement.**

Run No. <sup>2</sup>	Capsule	Duration (h)	Pressure (GPa)	Cell size (inch)	Polished surface	Pixel size <sup>3</sup> ( $\mu\text{m}/\text{pixel}$ )	Number of measured angle	Dihedral angle ( $^{\circ}$ )	C.I. <sup>4+</sup>	C.I. <sup>4-</sup>
DY06b	MgO	0.25	1.0	3/4	horizontal	0.185	231	42.9	1.8	1.3
DY01a	MgO	2	1.0	3/4	horizontal	0.185	290	36.2	1.6	1.2
TP01a	MgO	4	1.0	3/4	horizontal	0.204	331	35.5	2.0	1.8
TP11a	MgO	8	1.0	3/4	vertical	0.143	300	43.8	2.0	2.6
TP02a	MgO	2	0.5	3/4	horizontal	0.204	310	42.8	1.2	2.1
TP07a	MgO	2	0.75	3/4	vertical	0.143	304	45.6	1.1	1.4
TP04a	MgO	2	1.5	3/4	horizontal	0.204	303	35.0	0.9	1.3
TP16	MgO	2	3.0	1/2	vertical	0.143	168	30.3	2.5	3.3
TP10a	Al <sub>2</sub> O <sub>3</sub>	0.25	1.0	3/4	vertical	0.143	301	45.6	1.6	1.3
DY04b	Al <sub>2</sub> O <sub>3</sub>	2	1.0	3/4	horizontal	0.143	205	43.0	1.3	1.2
TP10b	BN	0.25	1.0	3/4	Vertical	0.143	304	46.9	2.1	1.6
DY01b	BN	2	1.0	3/4	horizontal	0.204	189	29.7	2.3	2.3
TP01b	BN	4	1.0	3/4	horizontal	0.143	270	34.7	1.0	1.0
DY03a	BN	6	1.0	3/4	horizontal	0.143	205	31.7	4.1	3.4
TP11b	BN	8	1.0	3/4	vertical	0.143	233	47.9	3.1	3.1
TP07b	BN	2	0.75	3/4	horizontal	0.204	309	48.2	1.7	2.0
TP04b	BN	2	1.5	3/4	vertical	0.204	307	35.3	1.6	1.3
TP15	BN	2	3.0	1/2	vertical	0.204	305	30.0	2.7	2.0

<sup>1</sup>All experiments were performed at 1323 K.

<sup>2</sup>Last digits "a" and "b" in Run No. represent upper capsule position and lower one in 3/4-inch piston cell, respectively (Fig.1).

<sup>3</sup>Pixel size of the backscattered electron image used for dihedral angle measurement.

<sup>4</sup>95% confidence interval for median value of number of measurements.

**Table 2. Chemical compositions of recovered sample.**

Run No.	Capsule	P (GPa)	Time (h)	Phase	at%										Number of analyses		
					Fe	Error <sup>3</sup>	S	Error <sup>3</sup>	O	Error <sup>3</sup>	Mg	Error <sup>3</sup>	B	Error <sup>3</sup>		N	Error <sup>3</sup>
DY06b	MgO	1.0	0.25	Melt	49.61	0.06	35.22	0.40	15.16	0.39	-	-					10
				<sup>1</sup> Solid	98.56	0.12			1.44	0.12							6
DY01a	MgO	1.0	2	Melt	48.52	0.27	39.02	2.22	12.45	2.35	-	-					15
				<sup>1</sup> Solid	98.48	0.53			2.12	0.44							7
TP01a	MgO	1.0	4	Melt	49.18	0.35	45.09	2.23	5.71	2.46	-	-					11
				Solid	99.31	0.13	0.02	0.01	0.52	0.07	0.15	0.09					11
TP11a	MgO	1.0	8	Melt	49.04	0.17	45.00	1.19	5.89	1.26	0.07	0.04					23
				Solid	99.30	0.02	0.04	0.01	0.66	0.02	-	-					11
DY07a	MgO	1.0	12	<sup>1</sup> Melt	54.05	2.08	41.15	2.25	4.80	1.30							4
				<sup>1</sup> Solid	97.51	0.17			2.49	0.17							3
TP02a	MgO	0.5	2	Melt	50.33	0.32	41.72	0.90	7.89	1.03	0.06	0.03					30
				Solid	99.34	0.03	0.03	0.00	0.58	0.03	0.05	0.02					26
TP07a	MgO	0.75	2	Melt	48.62	0.28	40.44	1.42	10.94	1.59	-	-					17
				Solid	99.29	0.05	0.03	0.00	0.68	0.05	-	-					11
DY01a	MgO	1.0	2	Melt	48.52	0.27	39.02	2.22	12.45	2.35	-	-					15
				<sup>1</sup> Solid	98.48	0.53			2.12	0.44							7
TP04a	MgO	1.5	2	Melt	49.68	0.28	44.25	1.25	6.06	1.46	-	-					17
				Solid	99.48	0.02	0.04	0.01	0.48	0.03	-	-					11
TP16	MgO	3.0	2	Melt	58.83	0.66	38.43	0.46	2.73	0.41	-	-					16
				Solid	99.28	0.03	0.04	0.00	0.67	0.03	-	-					11
TP10a	Al <sub>2</sub> O <sub>3</sub>	1.0	0.25	Melt	49.07	0.31	34.76	1.21	15.75	1.23			0.42	0.17	-	-	24
				Solid	97.03	0.20	0.05	0.01	0.74	0.01			0.10	0.07	2.06	0.23	11
DY04b	Al <sub>2</sub> O <sub>3</sub>	1.0	2	Melt	48.91	0.38	37.72	1.69	13.36	1.77							15
				<sup>1</sup> Solid	98.56	0.08			1.44	0.08							6
TP10b	BN	1.0	0.25	Melt	49.59	0.39	38.86	1.66	11.18	1.78			0.37	0.12	-	-	23
				Solid	97.73	0.33	0.04	0.01	0.79	0.02			0.22	0.09	1.22	0.36	10
DY01b	BN	1.0	2	Melt	51.96	1.27	44.71	1.29	2.73	0.39			0.60	0.34	-	-	11
				<sup>1</sup> Solid	98.07	0.16	0.27		1.89	0.13							7
TP01b	BN	1.0	4	Melt	56.46	0.83	41.41	0.85	1.53	0.18			0.60	0.29	-	-	16
				Solid	98.83	0.16	0.04	0.01	0.82	0.03			0.28	0.18	0.02	0.04	7
DY03a	BN	1.0	6	Melt	56.04	0.67	41.96	0.69	1.63	0.11			0.37	0.17	-	-	16
				<sup>1</sup> Solid	98.67	0.11			1.33	0.11							6
TP11b	BN	1.0	8	Melt	57.42	0.32	41.31	0.32	0.98	0.10			0.28	0.14	-	-	14
				Solid ( <sup>2</sup> dark)	91.31	0.46	0.03	0.00	0.55	0.05			0.08	0.07	8.07	0.42	12
				Solid ( <sup>2</sup> light)	95.85	0.38	-	-	0.54	0.02			0.38	0.22	3.21	0.34	13
DY07b	BN	1.0	12	<sup>1</sup> Melt	58.00	0.45	39.13	0.45	2.87								5
				<sup>1</sup> Solid	98.12	0.48			2.36	0.11							2
TP07b	BN	0.75	2	Melt	49.11	0.26	40.93	1.64	9.47	1.74			0.49	0.15	0.00	0.00	19
				Solid	98.06	0.29	-	-	0.53	0.03			0.31	0.15	1.09	0.23	11
DY01b	BN	1.0	2	Melt	51.96	1.27	44.71	1.29	2.73	0.39			0.60	0.34	0.00	0.00	11
				<sup>1</sup> Solid	98.07	0.16	0.27		1.89	0.13							7
TP04b	BN	1.5	2	Melt	54.63	0.88	42.40	0.83	2.61	0.66			0.36	0.24	0.00	0.00	12
				Solid	97.97	0.30	0.03	0.00	0.55	0.03			0.34	0.18	1.11	0.24	11
TP15	BN	3.0	2	Melt	61.65	0.34	36.80	0.31	0.79	0.09			0.75	0.25	0.00	0.00	12
				Solid	96.75	0.32	0.05	0.01	0.59	0.02			0.46	0.19	2.15	0.27	12

<sup>1</sup>Results of qualitative analysis using EDS.

<sup>2</sup>Two solid phases with different N contents were observed.

<sup>3</sup>Standard error.

<sup>4</sup>"-" indicates below detection limit.

**Supplementary Table S1. Chemical compositions of capsule.**

Run no.	Capsule	P (GPa)	Time (h)	Phase	at%														Measured No.	
					Fe	Error <sup>2</sup>	S	Error <sup>2</sup>	O	Error <sup>2</sup>	Mg	Error <sup>2</sup>	Al	Error <sup>2</sup>	B	Error <sup>2</sup>	N	Error <sup>2</sup>		
<sup>1</sup> DY06b	MgO	1.0	0.25	Capsule	0.1				47.0		52.9									1
<sup>1</sup> DY01a	MgO	1.0	2	Capsule	2.0	1.3	1.9		47.3	1.0	50.3	1.5								4
TP01a	MgO	1.0	4	Capsule lim	28.0	1.3			46.4	0.5	25.6	0.8								2
				Capsule	0.2	0.0	0.0	0.0	49.4	0.1	50.4	0.1								
TP11a	MgO	1.0	8	Capsule lim	21.4	0.6	0.0	0.0	48.1	0.2	30.5	0.6								5
				Capsule	0.5	0.1	0.0	0.0	49.8	0.3	49.8	0.3								
<sup>1</sup> DY07a	MgO	1.0	12	Capsule lim	13.6	3.4	0.1	0.1	43.7	2.5	42.6	1.5								4
				Capsule	8.3	8.0			47.2	0.6	44.5	7.3								
TP02a	MgO	0.5	2	Capsule lim	28.0	1.3			46.4	0.5	25.6	0.8								2
				Capsule	0.6	0.4	0.0	0.0	48.6	0.2	50.8	0.5								
TP07a	MgO	0.75	2	Capsule lim	12.8	0.1	0.0	0.0	48.6	1.1	38.6	1.2								2
				Capsule	0.3	0.1	0.0	0.0	50.9	0.2	48.8	0.1								
<sup>1</sup> DY01a	MgO	1.0	2	Capsule lim	19.6	1.2	0.0	0.0	51.6	0.6	28.8	1.1								3
				Capsule	2.0	1.3	1.9		47.3	1.0	50.3	1.5								
TP04a	MgO	1.5	2	Capsule lim	28.0	1.3			46.4	0.5	25.6	0.8								2
				Capsule	0.1	0.1	0.0	0.0	51.2	0.1	48.6	0.0								
TP16	MgO	3.0	2	Capsule lim	10.0	0.5	0.0	0.0	50.2	0.1	39.7	0.6								2
				Capsule	0.2	0.0	0.0	0.0	50.2	0.8	49.6	0.8								
TP10a	Al <sub>2</sub> O <sub>3</sub>	1.0	0.25	Capsule lim	19.5	2.7	0.0	0.0	50.6	1.2	29.8	3.0								3
				Capsule	0.1	0.0	0.0	0.0	52.3	0.4			46.9	0.4	0.7	0.2	0.0	0.0		
<sup>1</sup> DY04b	Al <sub>2</sub> O <sub>3</sub>	1.0	2	Capsule	0.2				58.1				41.7							1
TP10b	BN	1.0	0.25	Capsule	0.4	0.1	0.0	0.0	0.8	0.1					44.3	0.4	54.5	0.4		5
				Reactant	16.2	0.0	0.2	0.0	58.9	0.0					24.3		0.3			
<sup>1</sup> DY01b	BN	1.0	2	Capsule	0.1	0.0	0.1	0.0	1.3						52.0	0.3	47.1	0.9		2
TP01b	BN	1.0	4	Capsule	0.2	0.0	0.0	0.0	1.2	0.0					58.4		40.2			1
				Reactant	14.7	0.1	0.2	0.0	50.0	1.4					35.1	1.4	0.0	0.0		
<sup>1</sup> DY03a	BN	1.0	6	Capsule	0.1				0.3						49.6		50.1			1
TP11b	BN	1.0	8	Capsule	0.0	0.0	0.0	0.0	0.3	0.0					42.5	0.2	57.2	0.2		5
				Reactant	1.8	0.2	0.0	0.0	87.7	2.8					8.6	1.9	1.9	1.0		
<sup>1</sup> DY07b	BN	1.0	12	Capsule	0.0	0.0	0.0	0.0	0.8						51.5		47.7			1
TP07b	BN	0.75	2	Capsule	0.0	0.0	0.0	0.0	1.1	0.1					43.3	0.2	55.6	0.3		4
				Reactant	26.3	11.9	0.5	0.3	48.2	1.9					25.1	10.4	0.0	0.0		
<sup>1</sup> DY01b	BN	1.0	2	Capsule	0.1	0.0	0.1	0.0	1.3						52.0	0.3	47.1	0.9		2
TP04b	BN	1.5	2	Capsule	0.8	0.6	0.0	0.0	1.9	1.3					53.2	1.7	44.1	3.4		5
				Reactant	14.9	0.4	44.1	5.3	0.3	0.0					48.9	3.2	0.0	0.0		
TP15	BN	3.0	2	Capsule	0.1	0.0	0.0	0.0	0.8	0.1					43.7	0.3	55.4	0.3		6
				Reactant	13.2	1.7	2.2	0.7	53.2	3.2					31.4	4.2	0.0	0.0		

<sup>1</sup>Results of qualitative analysis using EDS.

<sup>2</sup>Standard error. This is equal to the standard deviation of the original frequency distribution divided by the square root of the sample number.