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*Supplement of*

## **Anisotropic thermal transport properties of quartz: from $-120^{\circ}\text{C}$ through the $\alpha$ - $\beta$ phase transition**

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Table S 1: Low temperature  $\alpha$ -quartz single crystal thermal diffusivity  $D$  in [001] (i.e. along  $c$ -axis) and [100] (i.e. along  $a$ -axis) directions (averages of 3 independent measurements per  $T$ ). Thicknesses:  $d_{\text{LT}[001]} = 2.064(3)$  mm,  $d_{\text{LT}[100]} = 2.010(3)$  mm

<b>LT<sub>[001]</sub></b>		<b>LT<sub>[001]</sub></b>		<b>LT<sub>[100]</sub></b>		<b>LT<sub>[100]</sub></b>	
$T$	$D$	$T$	$D$	$T$	$D$	$T$	$D$
(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )
-119.2	15.70(78) <sup>a</sup>	129.7	3.46(7)	-118.9	7.97(35)	150.3	1.86(3)
-109.8	14.07(49)	139.7	3.32(7)	-110.0	7.32(33)	160.3	1.80(4)
-100.0	13.51(38)	149.8	3.16(6)	-99.6	6.81(20)	170.2	1.73(3)
-89.8	12.62(42)	159.8	3.03(7)	-90.6	6.41(19)	180.3	1.68(3)
-79.9	11.77(33)	169.7	2.92(5)	-80.9	6.02(17)	190.3	1.62(3)
-79.8	11.69(38)	179.8	2.80(6)	-80.1	5.98(18)	200.2	1.57(3)
-69.5	11.04(38)	189.8	2.69(5)	-70.3	5.69(15)	210.2	1.53(3)
-59.4	10.22(32)	199.8	2.60(6)	-59.6	5.33(15)	220.2	1.49(3)
-49.6	9.67(31)	209.8	2.50(6)	-49.7	5.01(12)	230.1	1.44(3)
-39.6	9.09(24)	219.8	2.42(6)	-39.7	4.72(15)	240.2	1.41(3)
-30.0	8.49(27)	229.8	2.33(5)	-29.5	4.46(10)	250.2	1.37(4)
-20.0	7.94(22)	239.8	2.25(5)	-19.3	4.22(10)	260.1	1.34(3)
-9.9	7.39(17)	249.8	2.18(5)	-9.5	3.98(9)	270.2	1.30(3)
0.0	6.95(19)	259.8	2.11(5)	0.5	3.76(10)	280.2	1.27(3)
10.0	6.52(16)	269.8	2.04(5)	10.2	3.55(8)	290.2	1.24(3)
19.7	6.16(12)	279.9	1.98(5)	20.3	3.35(7)	300.2	1.22(3)
29.7	5.78(18)	289.9	1.93(5)	29.8	3.19(7)	310.2	1.19(3)
40.5	5.42(12)	299.9	1.87(5)	39.8	3.01(6)	320.2	1.16(3)
50.4	5.10(13)	309.9	1.81(5)	49.6	2.87(7)	330.2	1.14(4)
60.3	4.82(9)	319.9	1.77(6)	59.8	2.72(8)	340.3	1.12(5)
70.3	4.57(9)	329.9	1.72(5)	69.9	2.59(5)	350.3	1.10(4)
80.1	4.33(10)	339.9	1.67(6)	79.9	2.48(4)	360.3	1.08(4)
89.6	4.17(7)	349.9	1.63(5)	90.0	2.37(4)	370.2	1.06(5)
89.7	4.16(8)	359.9	1.58(6)	100.0	2.26(5)	380.5	1.04(4)
100.1	3.97(11)	369.9	1.54(6)	110.7	2.18(4)	390.3	1.02(4)
100.2	3.95(8)	379.9	1.51(6)	120.2	2.09(3)	400.3	1.01(4)
110.1	3.79(7)	389.9	1.47(7)	130.2	2.01(3)		
120.1	3.61(7)	399.9	1.44(7)	140.3	1.93(4)		

<sup>a</sup> numbers in parentheses are  $2\sigma$  standard deviations of the last digits

Table S 2: Thermal diffusivity  $D$  measured across the  $\alpha$ - $\beta$  phase transition (averages of 3 independent measurements per  $T$ ). Thicknesses:  $d_{\text{HT1}[001]} = 1.999(3)$  mm,  $d_{\text{HT2}[001]} = 4.706(4)$  mm,  $d_{\text{HT1}[100]} = 1.986(3)$  mm and  $d_{\text{HT2}[100]} = 4.022(4)$  mm

<b>HT1<sub>[001]</sub></b>		<b>HT2<sub>[001]</sub></b>		<b>HT1<sub>[100]</sub></b>		<b>HT2<sub>[100]</sub></b>	
$T$	$D$	$T$	$D$	$T$	$D$	$T$	$D$
(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )
25.9	5.69(19)	25.6	5.37(27)	25.9	2.89(8)	25.4	3.08(15)
50.1	4.90(14)	50.6	4.68(18)	50.0	2.56(7)	50.1	2.69(7)
99.6	3.84(11)	99.7	3.67(7)	99.8	2.05(4)	99.7	2.18(5)
149.8	3.09(9)	149.9	2.92(7)	149.8	1.70(3)	149.7	1.79(3)
199.9	2.29(6)	200.0	2.40(8)	199.8	1.43(3)	199.7	1.52(4)
250.1	1.92(5)	250.0	1.80(5)	249.9	1.24(3)	249.8	1.17(3)
300.2	1.65(5)	300.3	1.54(4)	299.9	1.10(3)	299.9	1.04(3)
325.3	1.54(5)	325.3	1.44(5)	325.0	1.05(3)	325.0	0.98(3)
350.3	1.45(5)	350.4	1.35(4)	350.0	1.00(3)	350.0	0.93(3)
375.5	1.35(5)	375.3	1.27(5)	375.0	0.94(4)	375.0	0.89(3)
400.4	1.26(5)	400.3	1.20(5)	400.0	0.90(4)	400.0	0.85(3)
425.1	1.18(5)	425.2	1.13(5)	425.0	0.86(4)	425.1	0.82(4)
450.2	1.11(5)	450.2	1.07(6)	450.0	0.82(4)	450.1	0.79(4)
454.7	1.10(5)	454.7	1.07(6)	455.0	0.81(4)	455.0	0.79(4)
459.7	1.09(6)	459.7	1.05(5)	460.0	0.81(4)	460.0	0.78(4)
464.7	1.08(5)	464.7	1.04(5)	465.0	0.80(4)	465.0	0.78(4)
469.7	1.07(5)	469.7	1.03(6)	470.0	0.80(4)	470.0	0.78(4)
474.7	1.06(6)	474.7	1.02(6)	475.0	0.79(4)	475.0	0.77(4)
479.7	1.05(6)	479.7	1.01(6)	480.0	0.79(4)	480.0	0.77(4)
484.7	1.03(6)	484.7	1.01(6)	485.0	0.78(4)	485.0	0.76(4)
489.8	1.02(5)	489.7	0.99(6)	490.1	0.78(4)	490.0	0.75(4)
494.7	1.01(6)	494.7	0.98(6)	495.2	0.77(4)	495.0	0.75(5)
499.7	1.00(6)	499.7	0.97(6)	500.1	0.76(4)	500.0	0.75(5)
504.7	0.99(6)	504.7	0.96(6)	505.2	0.76(4)	505.0	0.74(4)
509.7	0.98(5)	509.7	0.95(6)	510.1	0.75(4)	510.0	0.74(4)
514.7	0.97(6)	514.7	0.94(6)	515.0	0.75(4)	515.0	0.73(5)
519.7	0.96(6)	519.6	0.93(6)	520.1	0.74(4)	520.0	0.72(4)
524.7	0.95(6)	524.7	0.92(5)	525.0	0.74(4)	525.0	0.72(5)
529.8	0.94(6)	529.7	0.91(6)	530.1	0.73(4)	530.1	0.73(5)
534.6	0.93(6)	534.6	0.89(6)	535.1	0.73(5)	535.0	0.72(5)
539.6	0.91(6)	539.7	0.88(6)	540.0	0.72(4)	540.0	0.71(5)
544.6	0.90(6)	544.7	0.87(7)	545.0	0.72(4)	545.0	0.70(5)
549.7	0.89(6)	549.7	0.85(6)	550.0	0.71(4)	550.0	0.70(5)
551.6	0.88(6)	551.6	0.85(7)	552.0	0.71(5)	552.1	0.70(5)
553.6	0.87(6)	553.6	0.84(6)	554.0	0.70(4)	554.0	0.70(5)

(Table S 2 continued)

<b>HT1<sub>[001]</sub></b>		<b>HT2<sub>[001]</sub></b>		<b>HT1<sub>[100]</sub></b>		<b>HT2<sub>[100]</sub></b>	
<i>T</i>	<i>D</i>	<i>T</i>	<i>D</i>	<i>T</i>	<i>D</i>	<i>T</i>	<i>D</i>
(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )
(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )
555.5	0.87(6)	555.6	0.84(6)	556.1	0.70(5)	556.1	0.69(5)
557.6	0.86(6)	557.6	0.83(7)	558.0	0.70(5)	558.0	0.69(5)
559.6	0.86(6)	559.6	0.77(19)	560.0	0.69(5)	560.0	0.69(4)
561.6	0.86(6)	561.6	0.81(8)	562.0	0.69(4)	562.0	0.68(5)
563.6	0.84(6)	563.6	0.79(6)	564.0	0.68(4)	564.0	0.68(5)
565.6	0.83(6)	565.6	0.79(6)	566.0	0.68(4)	566.0	0.68(5)
567.6	0.82(6)	567.6	0.77(7)	568.0	0.67(4)	568.0	0.67(5)
569.6	0.80(6)	569.6	0.75(7)	570.0	0.66(4)	570.0	0.66(5)
571.6	0.77(7)	571.7	0.72(14)	572.0	0.65(5)	572.0	0.65(4)
573.7	0.74(11)	573.6	0.58(35)	574.0	0.64(6)	574.0	0.65(5)
575.6	0.63(28)	575.7	0.91(24)	576.0	0.59(12)	575.9	0.62(6)
577.6	0.89(21)	577.6	0.94(8)	578.0	0.55(17)	578.0	0.58(17)
579.6	0.93(7)	579.6	0.96(7)	580.0	0.73(20)	580.0	0.68(18)
581.6	0.94(6)	581.6	0.96(7)	582.0	0.81(8)	582.0	0.79(10)
583.6	0.95(6)	583.6	0.97(7)	584.0	0.82(6)	584.0	0.82(5)
585.6	0.95(6)	585.6	0.98(7)	586.0	0.83(5)	586.0	0.82(5)
587.6	0.96(6)	587.6	0.97(6)	588.0	0.83(5)	588.1	0.83(5)
589.6	0.96(6)	589.5	0.98(6)	590.0	0.84(5)	590.1	0.83(5)
594.7	0.97(5)	594.6	0.97(6)	595.0	0.84(5)	595.0	0.84(6)
599.7	0.97(5)	599.7	0.99(5)	600.0	0.85(4)	600.0	0.85(5)
604.7	0.97(5)	604.6	0.99(5)	605.0	0.85(4)	605.1	0.85(4)
609.7	0.97(4)	609.6	0.98(5)	610.0	0.85(3)	610.0	0.85(4)
614.7	0.97(4)	614.7	0.99(4)	615.0	0.85(3)	615.0	0.85(4)
619.7	0.98(3)	619.7	0.99(3)	620.0	0.85(3)	620.0	0.85(4)
624.7	0.98(3)	624.7	0.99(4)	625.0	0.86(3)	625.0	0.85(5)
629.8	0.98(3)	629.7	1.01(3)	629.9	0.86(2)	630.0	0.85(2)
634.7	0.98(3)	634.6	0.98(5)	634.9	0.86(2)	635.0	0.85(3)
639.7	0.98(2)	639.7	1.01(5)	639.9	0.86(2)	640.0	0.83(3)
644.7	0.98(3)			645.0	0.86(2)	645.0	0.86(4)
649.7	0.98(2)			650.0	0.86(2)	650.0	0.86(3)
675.1	0.99(3)			675.0	0.86(2)	675.0	0.85(9)
700.1	0.98(3)			699.9	0.86(2)	700.0	0.63(13)
725.2	0.98(3)			724.9	0.86(2)	724.9	0.90(30)
750.1	0.97(3)			749.8	0.86(3)		
775.1	0.96(4)			774.8	0.87(5)		
800.1	1.03(9)						

Table S 3: Thermal diffusivity  $D$  measured for thick ( $d_{[001]} = 9.965(5)$  mm,  $d_{[100]} = 11.089(6)$  mm) quartz single crystal specimens over the  $\alpha$ - $\beta$  phase transition (averages of 3 independent measurements per  $T$ )

<b>[001]</b>		<b>[100]</b>	
$T$	$D$	$T$	$D$
(°C)	(mm <sup>2</sup> s <sup>-1</sup> )	(°C)	(mm <sup>2</sup> s <sup>-1</sup> )
400.1	1.22(9)	399.9	0.90(6)
425.1	1.15(7)	450.2	0.86(5)
450.3	1.13(9)	500.0	0.83(16)
475.2	1.08(8)	540.3	0.77(13)
500.3	0.97(7)	560.2	0.68(10)
525.5	1.00(14)	570.8	0.55(15)
540.3	0.98(12)	572.9	0.77(18)
560.2	0.89(20)	574.9	1.15(14)
565.0	0.78(12)	580.0	1.20(9)
568.9	0.80(15)	585.0	1.19(14)
570.8	0.63(65)	589.9	1.25(13)
572.9	1.01(42)	620.4	1.21(9)
574.9	1.01(22)	650.6	1.33(23)
579.9	1.07(23)	700.6	1.26(22)
585.0	1.05(24)		
590.0	1.02(24)		
600.0	1.13(33)		
620.3	1.09(9)		
650.1	1.14(21)		
675.0	1.12(27)		
700.2	1.14(18)		
725.0	1.14(35)		

Table S 4:  $LT_{[001]}$  ratio of direct radiative heat transfer  $T_{0,rad}$  to theoretical adiabatic maximum temperature  $T_{max}$

$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)
-120.0	0.5(1) <sup>a</sup>	-20.1	0.4(1)	119.9	0.5(1)	270.0	4.1(10)
-119.2	1.1(3)	-20.1	0.2(1)	129.6	0.8(2)	279.8	4.3(11)
-119.1	1.7(4)	-19.8	0.5(1)	149.7	1.3(3)	279.8	4.0(10)
-118.6	0.6(1)	-10.1	2.0(5)	149.7	1.8(4)	280.0	3.4(8)
-110.6	0.1(0)	-10.0	0.3(1)	150.1	1.5(4)	289.8	4.6(12)
-110.1	1.0(3)	-9.6	1.5(4)	159.7	1.6(4)	289.8	4.1(10)
-109.7	0.8(2)	-0.2	0.9(2)	159.7	2.6(6)	290.0	5.0(12)
-109.7	0.6(1)	-0.1	0.9(2)	160.0	2.0(5)	299.8	3.8(10)
-100.2	0.3(1)	0.4	1.4(3)	169.6	1.9(5)	299.8	4.8(12)
-99.9	1.2(3)	9.8	0.4(1)	169.7	1.8(5)	300.0	4.9(12)
-99.9	0.8(2)	9.8	0.7(2)	169.9	2.1(5)	309.8	4.9(12)
-99.9	0.3(1)	10.3	0.4(1)	179.6	1.7(4)	309.8	4.5(11)
-99.8	0.4(1)	19.6	1.7(4)	179.7	2.2(5)	310.0	4.3(11)
-90.1	0.7(2)	20.1	0.5(1)	180.0	1.6(4)	319.8	3.6(9)
-90.0	0.4(1)	29.6	1.3(3)	189.6	2.2(6)	319.8	3.9(10)
-89.9	1.4(3)	29.7	0.9(2)	189.7	2.3(6)	320.0	5.0(12)
-89.9	1.2(3)	29.9	0.9(2)	190.0	2.0(5)	329.8	5.4(13)
-89.6	0.8(2)	40.1	1.3(3)	199.7	2.3(6)	329.8	5.1(13)
-89.5	0.6(2)	40.4	1.8(4)	199.7	2.7(7)	330.0	4.3(11)
-80.7	0.8(2)	40.9	1.4(4)	200.0	3.0(7)	339.8	6.2(15)
-80.4	0.6(1)	50.3	0.7(2)	209.7	2.7(7)	339.8	6.3(16)
-80.0	0.2(1)	50.9	0.5(1)	209.7	1.9(5)	340.0	6.0(15)
-79.8	0.8(2)	59.9	0.3(1)	210.0	3.0(7)	349.8	5.7(14)
-79.8	0.6(2)	60.8	0.3(1)	219.7	2.9(7)	349.8	6.0(15)
-79.5	0.0(3)	69.7	0.9(2)	219.7	2.9(7)	350.0	6.7(17)
-79.2	0.4(1)	70.3	0.9(2)	220.0	2.6(7)	359.8	5.0(13)
-69.7	0.8(2)	70.8	1.0(2)	229.7	2.1(5)	359.8	5.1(13)
-69.5	0.2(1)	79.8	0.4(1)	229.7	3.3(8)	360.1	5.3(13)
-69.3	0.8(2)	89.1	1.0(3)	230.0	1.8(4)	369.8	6.6(17)
-59.7	1.2(3)	89.6	1.0(3)	239.7	3.3(8)	369.8	7.4(18)
-59.4	0.5(1)	89.6	1.1(3)	239.7	3.1(8)	370.1	6.8(17)
-59.2	0.6(2)	89.9	0.9(2)	240.0	2.4(6)	379.8	6.1(15)
-49.8	0.5(1)	90.0	0.3(1)	249.7	2.7(7)	379.8	6.4(16)
-49.6	0.4(1)	99.6	0.7(2)	249.7	3.5(9)	380.0	6.6(17)
-49.4	0.4(1)	99.6	0.1(0)	250.0	3.5(9)	389.8	7.7(19)
-40.2	1.0(3)	100.0	1.6(4)	259.7	3.2(8)	389.9	7.7(19)
-39.6	0.4(1)	100.8	0.8(2)	259.7	3.4(8)	390.1	7.7(19)
-39.0	1.1(3)	100.9	1.6(4)	260.0	3.9(10)	399.8	8.1(20)
-30.0	0.7(2)	109.6	0.5(1)	269.7	3.2(8)	399.9	6.2(15)
-29.9	0.6(1)	119.6	1.2(3)	269.8	4.2(10)	400.0	6.3(16)

<sup>a</sup> numbers in parentheses are estimated uncertainties

Table S 5:  $LT_{[100]}$  ratio of direct radiative heat transfer  $T_{0,rad}$  to theoretical adiabatic maximum temperature  $T_{max}$ 

$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)
-119.0	0.3(1)	-9.9	0.4(1)	130.1	1.8(5)	270.6	2.7(7)
-119.0	2.5(6)	-9.6	0.5(1)	130.7	2.2(5)	279.9	3.8(9)
-118.9	0.1(0)	-9.1	0.9(2)	139.8	2.3(6)	280.1	3.9(10)
-111.8	0.5(1)	0.1	1.8(4)	140.2	2.3(6)	280.6	2.9(7)
-110.5	1.1(3)	0.4	1.0(2)	140.8	2.6(6)	289.9	3.3(8)
-110.2	1.0(2)	0.9	0.9(2)	149.9	1.9(5)	290.1	4.2(10)
-109.1	0.6(2)	10.1	1.9(5)	150.2	2.8(7)	290.6	4.4(11)
-100.3	1.7(4)	10.1	1.0(2)	150.8	1.7(4)	299.9	4.5(11)
-100.2	0.8(2)	10.4	0.7(2)	159.9	2.4(6)	300.1	3.8(9)
-99.6	1.3(3)	19.9	0.7(2)	160.2	1.1(3)	300.6	4.5(11)
-99.6	0.6(2)	20.2	1.8(4)	160.8	2.0(5)	309.9	4.4(11)
-99.4	0.9(2)	20.8	0.9(2)	169.8	2.7(7)	310.1	4.8(12)
-98.4	0.6(2)	29.6	1.2(3)	170.1	2.0(5)	310.7	4.9(12)
-91.9	1.6(4)	29.7	0.8(2)	170.7	1.4(3)	319.9	4.3(11)
-91.2	0.6(2)	30.2	1.7(4)	179.9	2.0(5)	320.1	4.2(10)
-90.5	0.6(2)	39.2	1.2(3)	180.2	2.1(5)	320.7	4.2(10)
-90.2	0.2(1)	39.9	1.0(3)	180.8	2.7(7)	329.9	4.9(12)
-90.1	0.6(2)	40.3	1.4(4)	189.9	2.8(7)	330.1	5.1(13)
-89.9	1.6(4)	49.5	0.8(2)	190.2	3.2(8)	330.7	4.8(12)
-81.1	1.8(4)	49.7	1.7(4)	190.8	2.3(6)	339.9	4.8(12)
-80.8	0.2(1)	49.7	1.5(4)	199.9	3.3(8)	340.2	4.4(11)
-80.7	1.2(3)	59.6	1.7(4)	200.1	3.1(8)	340.7	5.1(13)
-80.5	1.0(3)	59.7	1.3(3)	200.6	2.4(6)	350.0	5.3(13)
-80.0	1.5(4)	60.0	2.8(7)	209.9	2.3(6)	350.2	6.4(16)
-80.0	0.9(2)	69.7	1.7(4)	210.1	2.9(7)	350.7	5.4(13)
-79.9	0.3(1)	69.8	1.4(4)	210.6	3.4(9)	360.0	4.8(12)
-70.3	1.4(4)	70.2	1.1(3)	219.9	3.1(8)	360.2	6.5(16)
-69.8	0.5(1)	79.7	1.1(3)	220.1	2.5(6)	360.8	4.5(11)
-59.8	0.7(2)	79.8	0.9(2)	220.6	3.0(7)	369.9	6.8(17)
-59.6	0.4(1)	80.3	1.2(3)	229.9	2.7(7)	370.1	5.9(15)
-59.5	0.4(1)	89.7	1.3(3)	230.0	2.9(7)	370.7	5.3(13)
-49.9	0.4(1)	89.9	2.4(6)	230.5	3.3(8)	380.2	6.7(17)
-49.6	0.9(2)	90.4	2.1(5)	239.9	3.6(9)	380.6	7.4(19)
-49.5	0.4(1)	99.7	1.9(5)	240.1	2.9(7)	380.8	5.9(15)
-39.9	0.7(2)	99.9	1.8(4)	240.6	3.3(8)	390.0	6.7(17)
-39.6	0.7(2)	100.4	1.2(3)	249.9	3.9(10)	390.2	7.6(19)
-39.5	0.5(1)	110.4	1.6(4)	250.1	3.1(8)	390.8	7.7(19)
-29.7	1.1(3)	110.8	2.4(6)	250.6	3.7(9)	400.0	7.5(19)
-29.4	0.6(1)	110.8	2.2(5)	259.9	4.1(10)	400.2	7.2(18)
-29.3	0.4(1)	119.8	2.0(5)	260.0	3.7(9)	400.8	8.0(20)
-19.6	0.4(1)	120.1	2.8(7)	260.5	3.9(10)		
-19.3	0.2(1)	120.8	1.6(4)	269.9	4.0(10)		
-19.1	1.2(3)	129.8	2.1(5)	270.1	3.8(9)		



Table S 6: HT1<sub>[001]</sub> ratio of direct radiative heat transfer  $T_{0,rad}$  to theoretical adiabatic maximum temperature  $T_{max}$

$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)
25.8	1.5(4)	474.8	6.3(16)	553.8	13.9(35)	589.7	1.8(5)
25.9	1.0(3)	479.6	6.3(16)	555.2	15.2(38)	589.8	1.3(3)
25.9	0.0(2)	479.8	6.1(15)	555.7	14.2(35)	594.4	1.4(4)
49.6	5.6(14)	479.8	6.1(15)	555.7	14.9(37)	594.8	1.2(3)
49.9	3.4(8)	484.6	6.4(16)	557.2	15.8(40)	594.8	1.2(3)
50.8	0.7(2)	484.8	6.4(16)	557.7	15.2(38)	599.4	1.3(3)
99.4	0.4(1)	484.8	6.3(16)	557.8	15.3(38)	599.8	1.4(3)
99.6	3.3(8)	489.7	7.1(18)	559.2	16.9(42)	599.8	1.4(3)
99.8	2.1(5)	489.8	6.8(17)	559.7	16.2(41)	604.5	1.4(4)
149.6	1.9(5)	489.8	6.9(17)	559.8	16.2(40)	604.8	1.4(3)
149.7	3.2(8)	494.6	7.2(18)	561.2	18.3(46)	604.8	1.4(3)
150.0	2.6(7)	494.8	7.2(18)	561.7	17.1(43)	609.5	1.4(4)
199.8	2.0(5)	494.8	6.7(17)	561.8	17.4(44)	609.8	1.3(3)
199.8	1.9(5)	499.6	7.4(19)	563.2	19.1(48)	609.8	1.3(3)
200.2	1.9(5)	499.8	7.4(18)	563.7	18.9(47)	614.5	1.5(4)
249.8	2.8(7)	499.8	7.4(19)	563.8	18.3(46)	614.8	1.4(4)
249.9	2.0(5)	504.6	7.5(19)	565.2	21.6(54)	614.8	1.4(4)
250.5	2.3(6)	504.8	7.6(19)	565.7	21.0(53)	619.5	1.5(4)
299.9	2.8(7)	504.8	7.7(19)	565.8	20.4(51)	619.8	1.4(4)
300.0	2.9(7)	509.5	8.3(21)	567.2	24.9(62)	619.8	1.5(4)
300.7	2.8(7)	509.7	8.1(20)	567.7	24.5(61)	624.5	1.4(3)
324.9	3.0(8)	509.8	8.2(20)	567.8	24.6(62)	624.8	1.4(3)
325.1	2.9(7)	514.6	8.5(21)	569.2	29.2(73)	624.8	1.5(4)
325.8	3.0(7)	514.8	8.4(21)	569.7	29.2(73)	629.7	1.7(4)
349.9	3.1(8)	514.8	8.4(21)	569.8	29.3(73)	629.8	1.5(4)
350.2	3.2(8)	519.6	8.9(22)	571.2	36.8(92)	629.8	1.6(4)
350.8	3.2(8)	519.8	9.0(23)	571.7	37.8(94)	634.6	1.6(4)
375.0	3.6(9)	519.8	8.8(22)	571.8	38.8(97)	634.8	1.7(4)
375.4	3.6(9)	524.6	9.2(23)	573.5	47.9(120)	634.8	1.7(4)
376.0	3.6(9)	524.8	9.1(23)	573.7	102.5(256)	639.6	2.2(5)
400.0	4.0(10)	524.8	9.0(23)	573.8	136.9(342)	639.8	1.7(4)
400.3	3.9(10)	529.7	9.8(25)	575.3	142.1(355)	639.8	2.7(7)
400.9	4.0(10)	529.8	9.6(24)	575.8	58.1(145)	644.5	2.1(5)
424.8	4.6(11)	529.8	9.9(25)	575.8	63.9(160)	644.8	2.9(7)
425.1	4.4(11)	534.2	10.3(26)	577.3	14.4(36)	644.8	2.9(7)
425.5	4.7(12)	534.8	10.6(27)	577.7	11.2(28)	649.6	3.1(8)
449.9	5.1(13)	534.8	10.2(26)	577.8	10.9(27)	649.8	5.3(13)
450.1	5.3(13)	539.2	11.4(29)	579.2	5.6(14)	649.8	4.3(11)
450.5	5.1(13)	539.8	10.9(27)	579.7	4.7(12)	675.0	5.4(14)
454.6	5.4(13)	539.8	11.2(28)	579.8	5.0(13)	675.2	4.4(11)
454.8	5.0(13)	544.3	12.4(31)	581.2	3.8(9)	675.2	4.9(12)
454.8	5.5(14)	544.8	12.0(30)	581.7	4.6(12)	700.0	9.7(24)
459.6	5.5(14)	544.8	11.8(29)	581.8	4.5(11)	700.2	10.1(25)
459.8	5.7(14)	549.3	13.3(33)	583.3	3.1(8)	700.2	10.4(26)
459.8	5.6(14)	549.8	12.5(31)	583.7	2.7(7)	725.0	18.3(46)
464.6	5.8(14)	549.8	12.7(32)	583.8	2.9(7)	725.2	29.6(74)
464.8	5.6(14)	549.8	12.7(32)	585.3	2.3(6)	725.3	19.6(49)
464.8	5.9(15)	549.9	13.3(33)	585.7	2.2(6)	749.9	50.1(125)
469.6	5.8(14)	551.2	14.0(35)	585.8	2.0(5)	750.2	92.3(231)
469.8	5.9(15)	551.7	13.3(33)	587.3	1.8(5)	750.2	88.7(222)
469.8	5.7(14)	551.8	13.4(34)	587.7	1.9(5)	775.0	105.9(265)
474.6	5.9(15)	553.2	14.7(37)	587.8	1.6(4)	775.1	227.6(569)
474.8	5.8(14)	553.7	13.9(35)	589.3	1.7(4)	775.3	190.1(475)

Table S 7: HT<sub>2[001]</sub> ratio of direct radiative heat transfer  $T_{0,rad}$  to theoretical adiabatic maximum temperature  $T_{max}$

$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)
25.5	2.5(6)	469.8	6.1(15)	551.7	17.1(43)	585.3	8.5(21)
25.6	0.8(2)	474.5	6.6(17)	551.7	17.6(44)	585.7	7.2(18)
25.6	1.3(3)	474.7	6.9(17)	553.3	18.5(46)	585.7	9.1(23)
50.1	0.5(1)	474.8	6.9(17)	553.7	18.8(47)	587.3	9.6(24)
50.8	1.6(4)	479.5	7.2(18)	553.7	18.7(47)	587.7	9.7(24)
50.8	2.7(7)	479.8	7.0(17)	555.3	20.1(50)	587.7	9.4(24)
99.5	0.8(2)	479.8	7.4(18)	555.7	20.0(50)	589.3	11.1(28)
99.7	4.4(11)	484.5	7.0(18)	555.8	20.2(51)	589.6	10.6(26)
99.9	5.3(13)	484.7	7.1(18)	557.3	20.5(51)	589.7	9.6(24)
149.7	1.1(3)	484.8	7.3(18)	557.7	21.1(53)	594.4	12.0(30)
149.7	1.1(3)	489.5	7.6(19)	557.7	20.8(52)	594.7	13.9(35)
150.2	6.6(17)	489.7	7.6(19)	559.4	-3.9(-10)	594.8	14.4(36)
199.8	1.8(5)	489.8	7.7(19)	559.7	23.2(58)	599.5	14.8(37)
199.8	1.5(4)	494.5	8.2(20)	559.8	22.9(57)	599.7	16.7(42)
200.3	0.8(2)	494.7	7.9(20)	561.3	24.2(61)	599.8	13.7(34)
249.8	1.7(4)	494.8	8.1(20)	561.7	25.0(63)	604.4	21.6(54)
249.9	2.1(5)	499.5	8.4(21)	561.8	24.9(62)	604.7	19.1(48)
250.2	2.3(6)	499.7	8.1(20)	563.4	27.8(69)	604.8	19.9(50)
299.9	2.3(6)	499.8	8.5(21)	563.7	28.2(70)	609.5	22.3(56)
300.1	2.2(6)	504.5	8.2(20)	563.7	27.9(70)	609.7	30.4(76)
300.8	2.2(5)	504.7	8.0(20)	565.3	30.2(75)	609.7	32.3(81)
324.9	2.4(6)	504.8	8.5(21)	565.7	31.6(79)	614.6	32.7(82)
325.3	2.5(6)	509.5	8.1(20)	565.7	30.8(77)	614.7	33.1(83)
325.8	2.8(7)	509.7	8.7(22)	567.3	34.0(85)	614.8	30.2(76)
350.0	3.0(7)	509.8	8.8(22)	567.7	35.4(88)	619.5	35.6(89)
350.3	2.8(7)	514.5	9.1(23)	567.7	35.1(88)	619.8	41.8(104)
350.9	2.8(7)	514.7	9.6(24)	569.3	39.8(99)	619.8	47.7(119)
375.0	3.4(8)	514.8	9.0(23)	569.7	41.6(104)	624.5	51.7(129)
375.2	3.4(9)	519.5	10.0(25)	569.7	41.8(105)	624.7	53.4(134)
375.7	3.7(9)	519.7	10.1(25)	571.5	48.6(122)	624.8	55.5(139)
400.0	4.0(10)	519.7	10.2(25)	571.7	52.1(130)	629.5	73.9(185)
400.2	4.0(10)	524.5	10.3(26)	571.8	54.1(135)	629.7	77.0(193)
400.6	3.9(10)	524.7	11(27)	573.3	121.1(303)	629.8	81.9(205)
424.9	4.6(12)	524.8	11.4(29)	573.7	361.4(903)	634.4	99.9(250)
425.2	4.9(12)	529.5	11.6(29)	573.8	967.1(2418)	634.7	100.5(251)
425.5	4.8(12)	529.7	11.9(30)	575.6	21.8(54)	634.8	114.6(287)
449.9	5.1(13)	529.8	12.2(31)	575.7	20.1(50)	639.6	161.9(405)
450.1	5.5(14)	534.5	12.7(32)	575.8	18.6(47)	639.8	169.4(424)
450.5	5.2(13)	534.7	13.0(32)	577.3	10.2(25)	639.8	184.6(461)
454.5	5.4(13)	534.7	13.1(33)	577.7	9.3(23)	644.7	228.4(571)
454.8	5.3(13)	539.5	13.8(34)	577.7	9.9(25)	644.8	259.1(648)
454.8	5.3(13)	539.7	13.6(34)	579.3	7.3(18)	644.8	251.6(629)
459.5	6.0(15)	539.8	13.8(35)	579.7	8.3(21)	649.7	286.5(716)
459.8	6.0(15)	544.5	15.2(38)	579.7	8.8(22)	649.8	270.0(675)
459.8	5.8(14)	544.7	15.3(38)	581.3	8.3(21)	649.8	293.2(733)
464.5	6.2(15)	544.8	15.3(38)	581.7	6.9(17)	674.8	376.9(942)
464.8	6.0(15)	549.5	16.9(42)	581.8	6.4(16)	674.9	355.5(889)
464.8	5.6(14)	549.7	16.4(41)	583.3	8.5(21)	675.0	333.5(834)
469.5	6.4(16)	549.8	17.2(43)	583.7	8.3(21)		
469.8	6.3(16)	551.4	17.2(43)	583.7	6.3(16)		

Table S 8: HT1<sub>[100]</sub> ratio of direct radiative heat transfer  $T_{0,rad}$  to theoretical adiabatic maximum temperature  $T_{max}$ 

$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)
25.9	0.6(1)	479.8	5.4(13)	557.8	15.6(39)	599.8	2.1(5)
25.9	5.3(13)	479.9	5.5(14)	557.9	15.8(39)	599.9	2.8(7)
26.0	3.7(9)	480.2	5.4(13)	558.3	16.1(40)	600.3	2.6(7)
49.7	0.4(1)	484.8	6.4(16)	559.8	16.7(42)	604.8	2.2(5)
49.9	4.0(10)	484.9	5.7(14)	559.9	16.7(42)	604.9	2.1(5)
50.5	2.9(7)	485.2	6.6(17)	560.3	17.2(43)	605.3	2.2(6)
99.6	4.3(11)	489.8	5.8(14)	561.8	18.0(45)	609.8	2.5(6)
99.6	3.5(9)	490.0	5.9(15)	561.9	18.0(45)	609.9	2.2(6)
100.2	3.2(8)	490.6	6.1(15)	562.3	18.6(46)	610.2	2.7(7)
149.6	1.7(4)	494.9	6.4(16)	563.8	19.1(48)	614.8	2.7(7)
149.7	1.6(4)	495.0	6.3(16)	563.9	19.1(48)	614.9	2.7(7)
150.0	1.5(4)	495.7	6.2(15)	564.3	19.7(49)	615.2	2.4(6)
199.7	1.7(4)	499.8	6.4(16)	565.8	20.8(52)	619.8	2.2(6)
199.8	1.6(4)	500.0	6.5(16)	565.9	20.9(52)	619.9	2.7(7)
200.0	2.1(5)	500.6	6.8(17)	566.3	21.6(54)	620.2	2.4(6)
249.8	4.6(12)	505.0	6.8(17)	567.8	22.9(57)	624.9	2.8(7)
249.8	1.7(4)	505.0	6.8(17)	567.9	23.3(58)	624.9	3.1(8)
250.1	2.0(5)	505.6	7.2(18)	568.3	23.8(59)	625.2	3.5(9)
299.8	2.2(5)	509.8	7.0(17)	569.8	25.3(63)	629.8	3.1(8)
299.8	1.9(5)	510.0	7.2(18)	569.9	25.2(63)	629.9	3.2(8)
300.1	2.0(5)	510.6	7.2(18)	570.3	26.1(65)	630.1	3.0(7)
324.8	2.2(5)	514.8	7.6(19)	571.8	29.1(73)	634.8	3.7(9)
324.9	2.5(6)	514.9	7.4(19)	571.9	29.3(73)	634.9	3.0(7)
325.2	2.3(6)	515.4	7.6(19)	572.2	31.5(79)	635.1	3.4(9)
349.8	2.3(6)	519.8	8.0(20)	573.8	42.1(105)	639.8	3.5(9)
349.9	2.5(6)	519.9	8.1(20)	573.9	39.2(98)	639.9	4.0(10)
350.2	2.5(6)	520.5	8.1(20)	574.3	42.3(106)	640.1	3.3(8)
374.8	2.8(7)	524.8	8.5(21)	575.8	52.9(132)	644.8	4.0(10)
374.9	2.7(7)	524.9	8.6(21)	575.9	53.7(134)	644.9	4.1(10)
375.3	3.6(9)	525.4	8.6(21)	576.4	139.6(349)	645.2	4.2(10)
399.8	3.1(8)	529.8	9.3(23)	577.8	105.9(265)	649.8	4.8(12)
399.9	9.8(25)	530.0	9.1(23)	577.9	111.1(278)	649.9	4.5(11)
400.3	3.1(8)	530.5	9.3(23)	578.3	70.0(175)	650.2	5.3(13)
424.8	4.4(11)	534.8	10.0(25)	579.8	23.8(60)	674.9	6.7(17)
424.9	3.7(9)	534.9	10.0(25)	579.9	22.5(56)	674.9	7.7(19)
425.3	3.8(9)	535.5	10.4(26)	580.2	16.5(41)	675.1	6.3(16)
449.9	4.5(11)	539.8	10.7(27)	581.8	6.3(16)	699.8	13.8(34)
449.9	4.8(12)	539.9	10.6(27)	581.9	6.5(16)	699.9	13.2(33)
450.3	5.2(13)	540.4	10.7(27)	582.2	5.0(13)	700.1	10.8(27)
454.8	4.6(12)	544.8	11.5(29)	583.8	3.8(10)	724.8	36.7(92)
454.9	4.5(11)	544.9	11.7(29)	583.9	3.7(9)	724.8	39.6(99)
455.3	5.4(13)	545.3	11.7(29)	584.3	3.3(8)	725.0	30.9(77)
459.8	4.7(12)	549.8	12.8(32)	585.8	3.2(8)	749.8	122.2(306)
459.9	4.7(12)	549.9	12.9(32)	585.9	3.4(8)	749.8	143.2(358)
460.3	4.8(12)	550.4	12.9(32)	586.3	2.8(7)	749.9	106.1(265)
464.8	4.8(12)	551.8	13.6(34)	587.8	2.6(7)	774.8	302.8(757)
464.9	4.9(12)	551.9	14.1(35)	587.9	3.2(8)	774.8	351.0(877)
465.2	4.9(12)	552.4	13.6(34)	588.3	3.0(7)	774.9	282.1(705)
469.8	5.4(13)	553.8	14.1(35)	589.8	2.4(6)	799.8	594.9(1487)
469.9	5.6(14)	553.9	14.3(36)	589.9	2.8(7)	799.8	660.7(1652)
470.2	5.1(13)	554.4	14.4(36)	590.3	2.2(6)	799.8	752.5(1881)
474.8	5.1(13)	555.8	14.8(37)	594.8	2.4(6)		
474.9	5.2(13)	556.0	15.7(39)	594.9	2.3(6)		
475.2	5.0(12)	556.4	15.1(38)	595.3	2.2(6)		

Table S 9:  $HT_{2[100]}$  ratio of direct radiative heat transfer  $T_{0,rad}$  to theoretical adiabatic maximum temperature  $T_{max}$

$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)	$T$ (°C)	$T_{0,rad}/T_{max}$ (%)
25.3	0.0(4)	469.9	4.7(12)	550.3	12.7(32)	583.8	11.3(28)
25.4	1.3(3)	470.3	4.7(12)	551.9	13.3(33)	584.0	9.1(23)
25.4	1.9(5)	474.8	5.0(12)	552.0	13.3(33)	584.3	9.5(24)
49.6	0.2(1)	474.9	4.7(12)	552.3	13.7(34)	585.9	10.2(25)
49.9	0.2(1)	475.3	5.0(12)	553.8	14.1(35)	585.9	10.1(25)
50.9	0.5(1)	479.8	5.3(13)	554.0	14.4(36)	586.3	9.1(23)
99.5	1.9(5)	479.9	5.2(13)	554.3	14.1(35)	587.9	10.8(27)
99.6	1.0(2)	480.3	5.1(13)	555.9	14.8(37)	588.0	13.0(33)
99.9	4.3(11)	484.8	5.5(14)	556.0	14.9(37)	588.3	11.0(28)
149.5	0.0(0)	484.9	5.4(13)	556.3	15.2(38)	589.9	13.0(33)
149.7	0.5(1)	485.3	5.6(14)	557.8	15.2(38)	590.0	13.6(34)
149.9	1.2(3)	489.8	5.5(14)	557.9	15.9(40)	590.3	12.9(32)
199.7	0.9(2)	489.9	5.5(14)	558.2	15.7(39)	594.8	16.7(42)
199.7	0.3(1)	490.3	5.9(15)	559.8	16.4(41)	595.0	17.0(43)
199.8	0.9(2)	494.8	6.0(15)	560.0	16.7(42)	595.3	15.6(39)
249.7	0.0(0)	494.9	5.8(15)	560.3	16.9(42)	599.8	18.4(46)
249.8	0.0(1)	495.3	6.0(15)	561.8	17.6(44)	600.0	18.2(46)
249.9	0.0(1)	499.8	6.3(16)	562.0	18.4(46)	600.3	17.9(45)
299.8	1.6(4)	499.9	6.1(15)	562.3	18.5(46)	604.9	24.5(61)
299.8	0.0(2)	500.3	6.1(15)	563.8	18.8(47)	605.0	27.4(69)
300.2	0.0(10)	504.8	6.5(16)	563.9	19.0(48)	605.3	24.6(62)
324.8	2.0(5)	504.9	6.9(17)	564.2	19.6(49)	609.9	29.4(74)
324.9	2.0(5)	505.3	6.6(16)	565.8	20.8(52)	609.9	32.3(81)
325.2	1.9(5)	509.8	6.7(17)	566.0	21.0(53)	610.3	30.1(75)
349.8	2.3(6)	509.9	6.9(17)	566.3	21.3(53)	614.8	42.6(106)
349.9	1.9(5)	510.3	6.7(17)	567.8	22.3(56)	614.9	38.0(95)
350.3	2.2(5)	514.8	7.7(19)	568.0	22.5(56)	615.3	43.3(108)
374.8	2.5(6)	514.9	7.1(18)	568.3	22.6(57)	619.8	55.2(138)
374.9	2.5(6)	515.3	7.2(18)	569.8	25.5(64)	619.9	48.8(122)
375.3	2.7(7)	519.8	8.1(20)	569.8	24.9(62)	620.2	46.8(117)
399.8	3.1(8)	519.9	7.8(19)	570.3	26.0(65)	624.8	60.0(150)
399.9	2.9(7)	520.4	8.0(20)	571.8	29.2(73)	624.9	70.0(175)
400.3	2.9(7)	524.8	8.5(21)	571.9	28.5(71)	625.2	54.9(137)
424.8	3.4(8)	524.9	8.7(22)	572.3	29.3(73)	629.8	76.2(191)
425.0	3.3(8)	525.3	8.3(21)	573.8	61.2(153)	630.0	74.2(186)
425.4	3.6(9)	529.9	9.0(23)	573.9	60.8(152)	630.3	69.8(174)
449.9	3.9(10)	530.0	9.0(23)	574.2	60.8(152)	634.9	96.9(242)
450.0	3.9(10)	530.3	8.9(22)	575.8	70.3(176)	634.9	109(273)
450.3	3.9(10)	534.9	9.6(24)	575.9	71.7(179)	635.3	89.6(224)
454.8	5.8(14)	535.0	9.7(24)	576.1	76.9(192)	639.8	135.3(338)
454.9	4.3(11)	535.2	9.8(24)	577.8	132.0(330)	639.9	122.0(305)
455.3	4.0(10)	539.8	10.8(27)	577.9	175.1(438)	640.2	126.2(315)
459.8	5.1(13)	539.9	10.5(26)	578.3	415.2(1038)	644.8	166.3(416)
459.9	4.8(12)	540.3	10.1(25)	579.8	73.8(184)	644.9	165.8(414)
460.3	4.2(10)	544.9	12.0(30)	579.9	64.1(160)	645.2	152.1(380)
464.8	4.3(11)	544.9	11.4(29)	580.2	45.7(114)	649.8	214.9(537)
464.9	4.7(12)	545.3	11.5(29)	581.8	14.3(36)	649.9	208.4(521)
465.3	4.4(11)	549.8	13.1(33)	581.9	12.5(31)	650.2	215.4(538)
469.8	4.6(12)	549.9	12.9(32)	582.3	11.2(28)		