Density Dependence of the Room Temperature Thermal Conductivity of Atomic Layer Deposition Grown Amorphous Alumina (Al_2O_3), Supplementary Information

Caroline S. Gorham,[1] John T. Gaskins,[1] Gregory N. Parsons,[2] Mark D. Losego,[2] and Patrick E. Hopkins[1, a)]

[1)]*Department of Mechanical and Aerospace Engineering, University of Virginia, Charlottesville, Virginia 22904, USA*

[2)]*Department of Chemical and Biomolecular Engineering, North Carolina State University, Raleigh, North Carolina 27695, USA*

(Dated: 26 May 2014)

[a)]Electronic mail: phopkins@virginia.edu

TABLE I. This table provides atomic layer deposition growth temperature, T_g, of the amorphous alumina samples and pertient values for the physical properties studied herein. Amorphous Al_2O_3 film thickness, d, and refractive index, $\hat{n}$, were measured by spectroscopic ellipsometry. Volumetric mass density, ρ, and atomic density, n, were determined from a relationship to the measured refractive index calculated using a calibration consistent with prior reports.[1] Apparent longitudinal sound speeds, c_{L_1} and c_{L_2}, on quartz and Si substrates, respectively, were determined with picosecond acoustics. The thermal conductivities, κ_1 and κ_2, of our ALD-grown a-Al_2O_3 on quartz and Si substrates, respectively, were measured with TDTR.

T_g (°C)	$\hat{n}$	ρ (g/cm^3)	n (10^{22}/cm^3)	d (nm)	c_{L_1} (nm/ps)	c_{L_2} (nm/ps)	κ_1 (W/m/K)	κ_2 (W/m/K)
50	1.593	2.67	7.88	55.1	8.68	8.75	1.17	1.23
75	1.619	2.86	8.43	57.6	8.79	8.41	1.42	1.31
100	1.639	3.00	8.86	60.9	8.95	8.58	1.46	1.50
125	1.648	3.06	9.05	64.5	8.90	8.54	1.64	1.63
150	1.658	3.14	9.26	65.4	8.55	—-	1.65	——
200	1.656	3.12	9.22	63.2	8.84	8.72	1.66	1.68
250	1.649	3.07	9.07	56.3	8.59	8.80	1.68	1.67

REFERENCES

[1]K. K. Shih and D. B. Dove, Journal of Vacuum Science & Technology A **12**, 321 (1994).