

Supporting information for

Mechanical Properties of Atomic Layer Deposition–Reinforced Nanoparticle Thin Films

Lei Zhang,[†] Jacob H. Prosser,[†] Gang Feng,[‡] and Daeyeon Lee^{†,*}

[†]*Department of Chemical and Biomolecular Engineering, University of Pennsylvania, Philadelphia,
Pennsylvania 19104, United States*

[‡]*Department of Mechanical Engineering, Villanova University, Villanova, Pennsylvania 19085, United
States*

* *Address correspondence to daeyeon@seas.upenn.edu.*

Table S1 Hardness and modulus of bulk crystalline TiO₂ and Al₂O₃.

Materials	Mohs Hardness	Modulus (GPa)
TiO ₂	6.2 ¹	282 ²
Al ₂ O ₃	9.0 ¹	372 ³

Table S2 Hardness of amorphous SiO₂, TiO₂, and Al₂O₃.

Materials	Hardness (GPa)	Ref.
SiO ₂	2.41	4
	7.17	4
	8-10	5
	9.5	6
TiO ₂	4.4	7
	7.8	8
	8.7	9
Al ₂ O ₃	7	10
	8	11
	9	12
	12	13
	12	11

Table S3 Modulus of amorphous SiO₂, TiO₂, and Al₂O₃.

Materials	Modulus (GPa)	Ref.
SiO ₂	73	14
	70	15
	56	16
	18	17
	92	18
TiO ₂	169	8
	96	16
	144	19
	16.5-87.5	7
	140-170	20
Al ₂ O ₃	155	11
	110	21
	272	22
	180	14
	168	23

Table S4 Fracture toughness (K_C) of amorphous SiO_2 , TiO_2 , and Al_2O_3 .

Material	K_C ($\text{MPa}\cdot\text{m}^{1/2}$)	Ref.
SiO_2	0.77	24
	0.79	25
	0.5-0.9	26
TiO_2	0.65	27
	0.26-0.37	28
Al_2O_3	1.89	29
	2.4	30
	2.3	31
	1.7-2.1	32

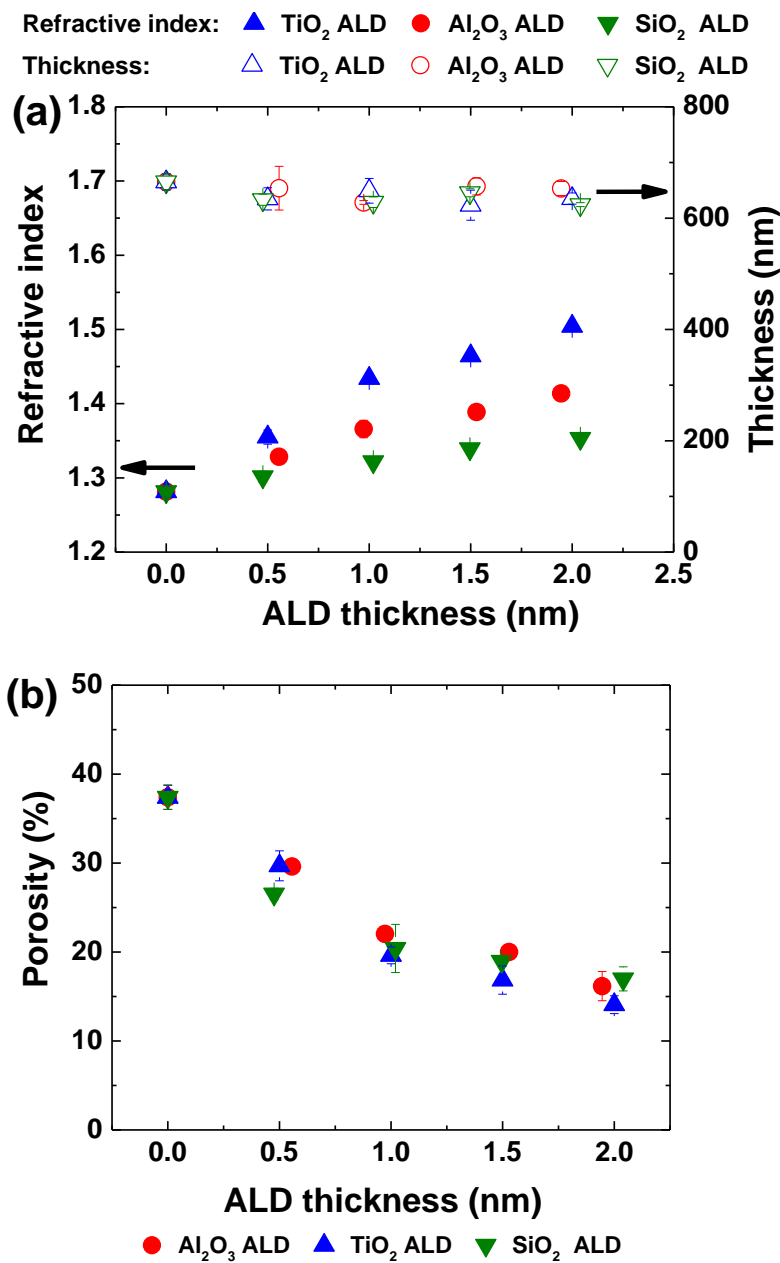


Figure S1. (a) Refractive index (solid symbols) and film thickness (hollow symbols) and (b) porosity of ALD-reinforced SiO₂ NTFs.

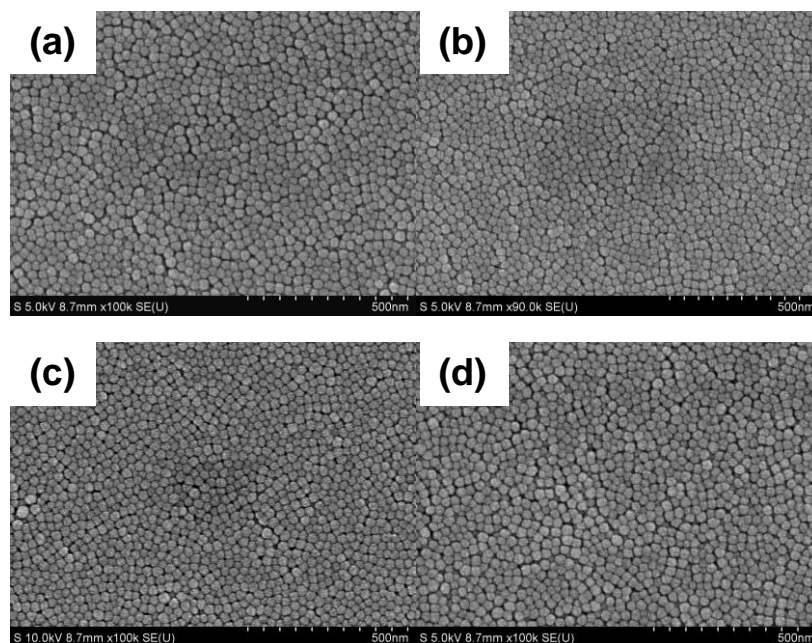


Figure S2. SEM micrographs of (a) as-assembled SiO₂ NTF, (b) 2 nm Al₂O₃ ALD-reinforced SiO₂ NTF, (c) 2 nm TiO₂ ALD-reinforced SiO₂ NTF and (d) 2 nm SiO₂ ALD-reinforced SiO₂ NTF.

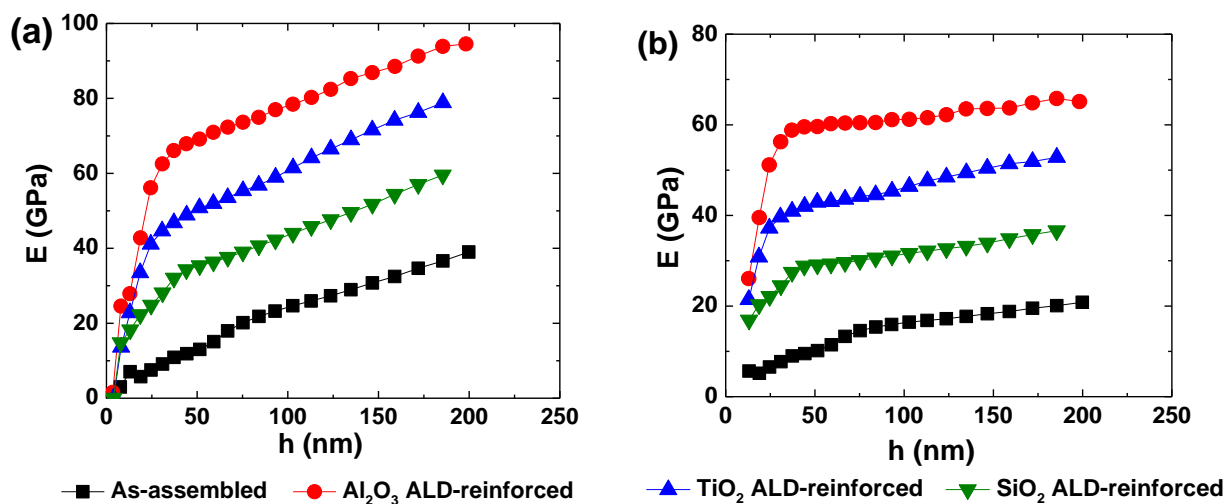


Figure S3. Modulus (E) as a function of indentation depth (h) of (a) 2 nm ALD-reinforced TiO₂ NTF without the substrate effect correction and (b) after correcting for the substrate effect.

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