Supporting Information

Atomic Layer Coating to Inhibit Surface Crystallization of Amorphous Pharmaceutical Powders

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Amorphous Solid Dispersion Characterization

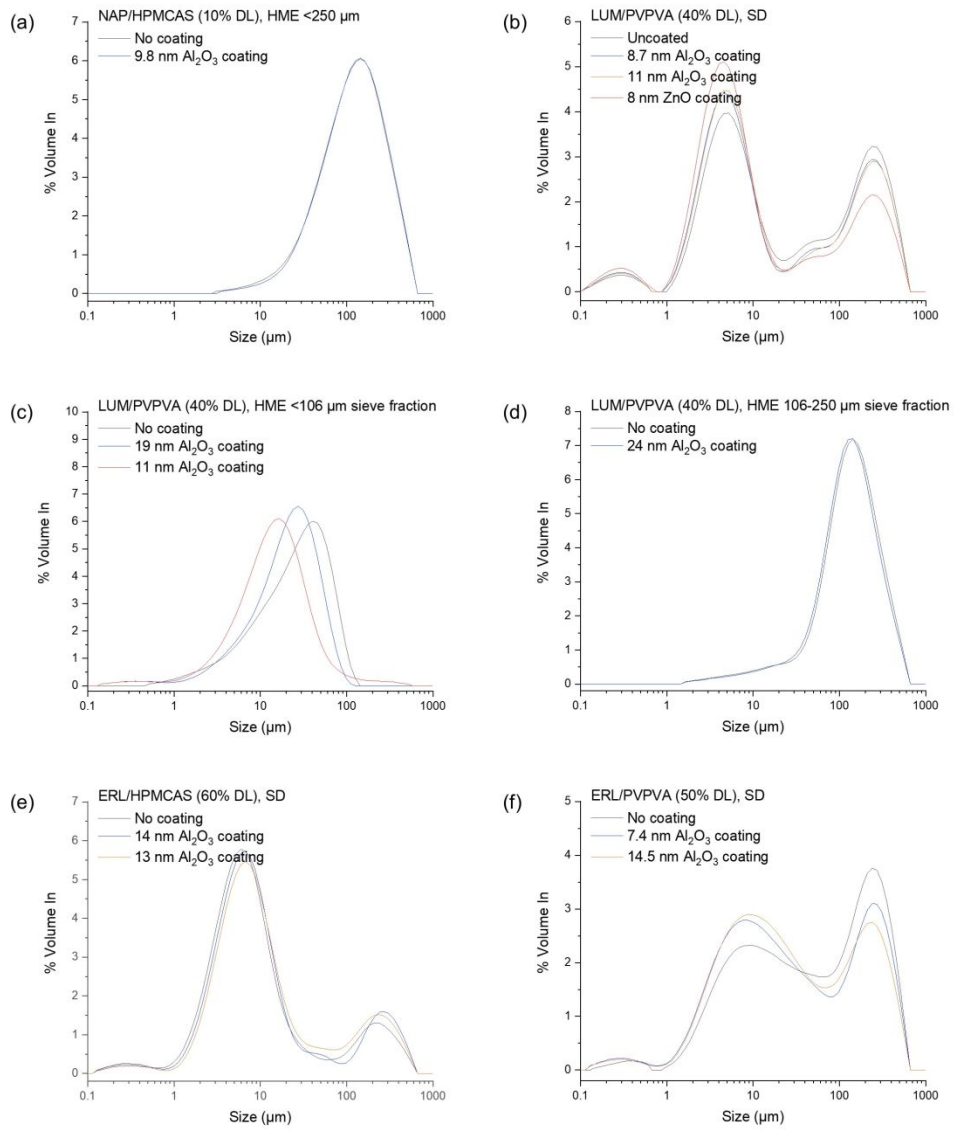

Figure S1. Particle size analysis of ASD formulations with and without ALCs: (a) 10% DL NAP/HPMCAS, (b-d) 40% LUM/PVPVA, (e) 60% DL ERL/HPMCAS, and (f) 50% ERL/PVPVA.

Table S1. Glass transition temperature (T_g onset) of ASD samples.

Formulation	**T_g onset, °C**
EH60 (no coating)	44.6
EH60 (Al_2O_3 13 nm)	43.9
EH60 (Al_2O_3 14 nm)	44.0
EP50 (no coating)	44.6
EP50 (Al_2O_3 7.4 nm)	44.2
EP50 (Al_2O_3 14 nm)	44.1
NH10 (no coating)	78.1
NH10 (Al_2O_3 9.8 nm)	80.7
LP40-SD (no coating)	65.5
LP40-SD (Al_2O_3 8.0 nm)	66.4
LP40-SD (Al_2O_3 11 nm)	63.7
LP40-SD (ZnO 8.7 nm)	57.3
LP40-HME-A (no coating)	52.7
LP40-HME-A (Al_2O_3 11 nm)	51.6
LP40-HME-A (Al_2O_3 19 nm)	53.0
LP40-HME-B (no coating)	53.2
LP40-HME-B (Al_2O_3 24 nm)	51.6

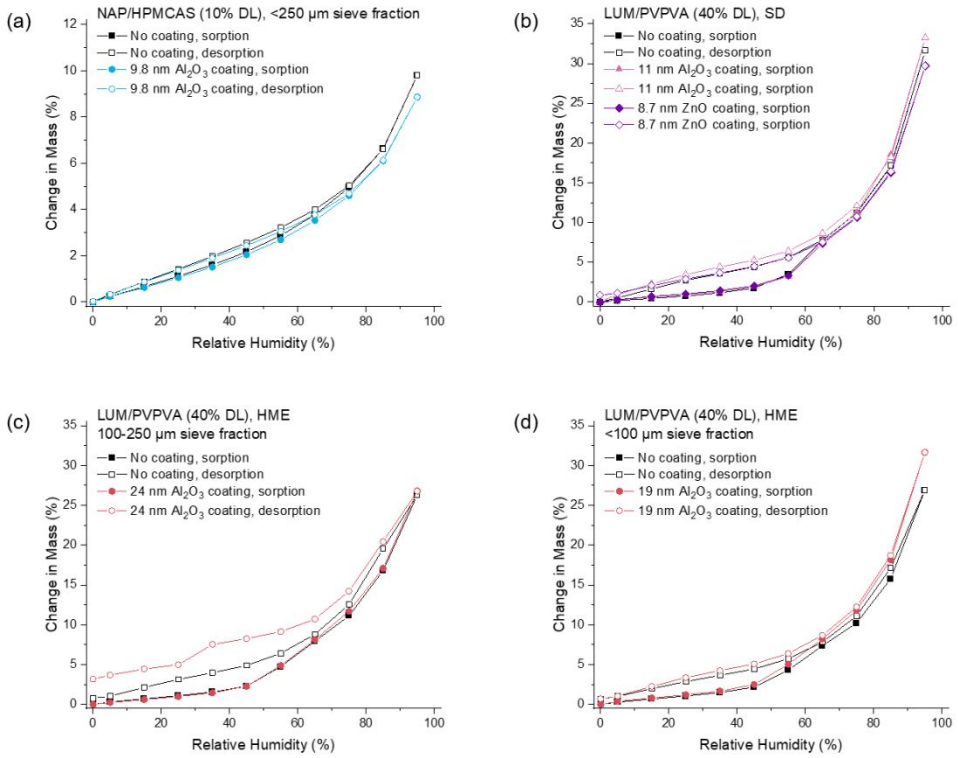

Figure S2. Representative water sorption isotherms of ASD formulations with and without ALC: (a) 10% DL NAP/HPMCAS and (b-d) 40% LUM/PVPVA.

Stability Study

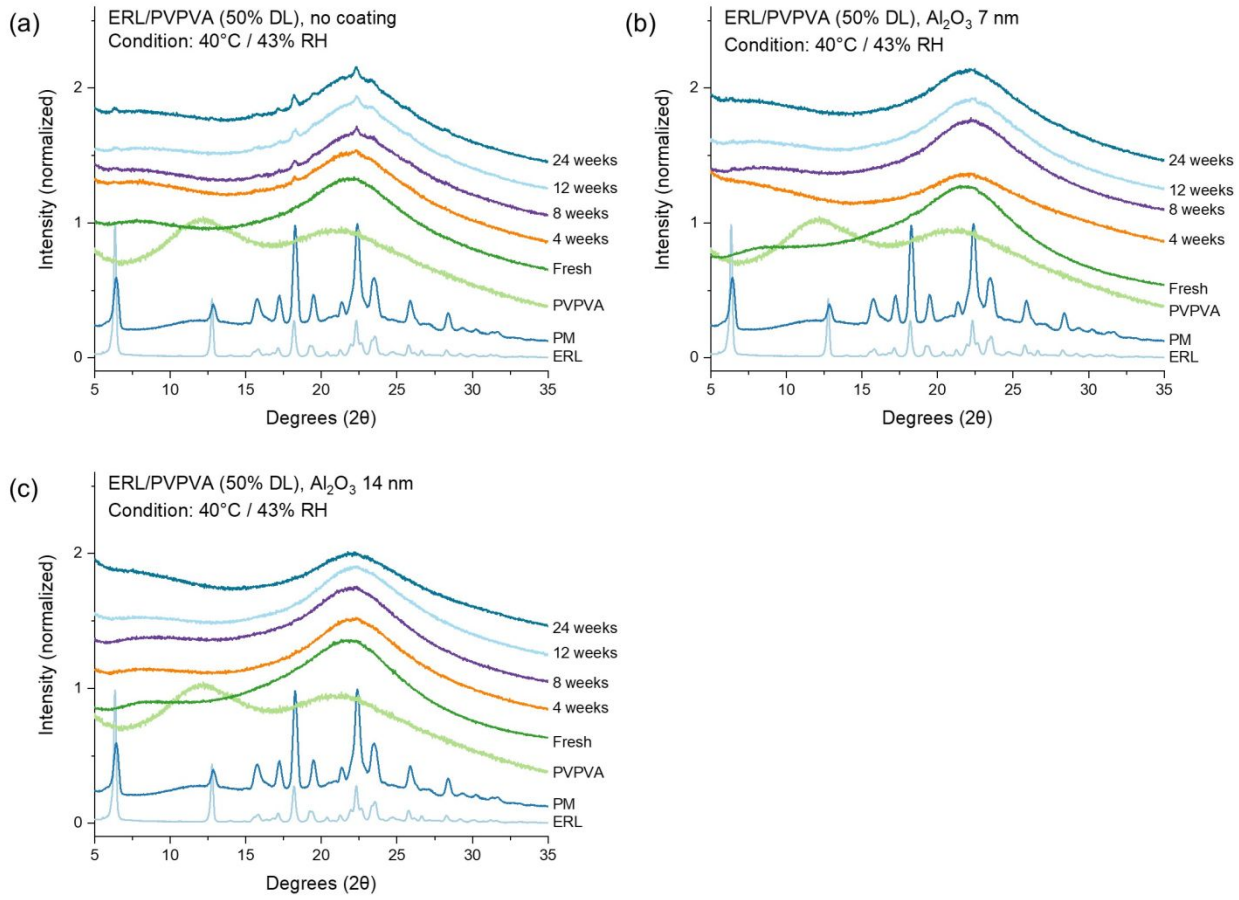

Figure S3. XRPD patterns of components and ASD systems over 48 weeks stability: ERL/PVPVA (40℃/43% RH).

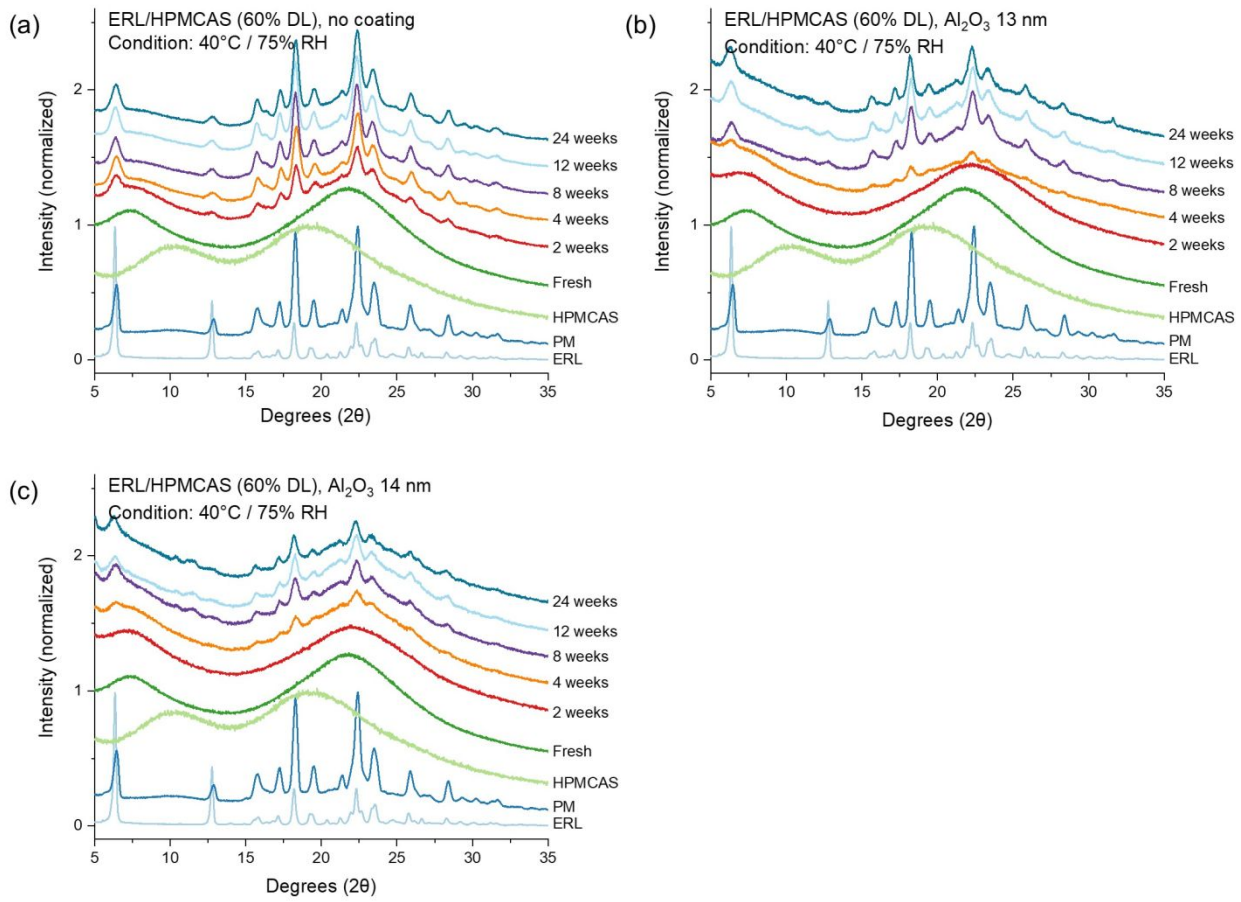

Figure S4. XRPD patterns of components and ASD systems over 48 weeks stability: ERL/HPMCAS (40°C/75% RH).

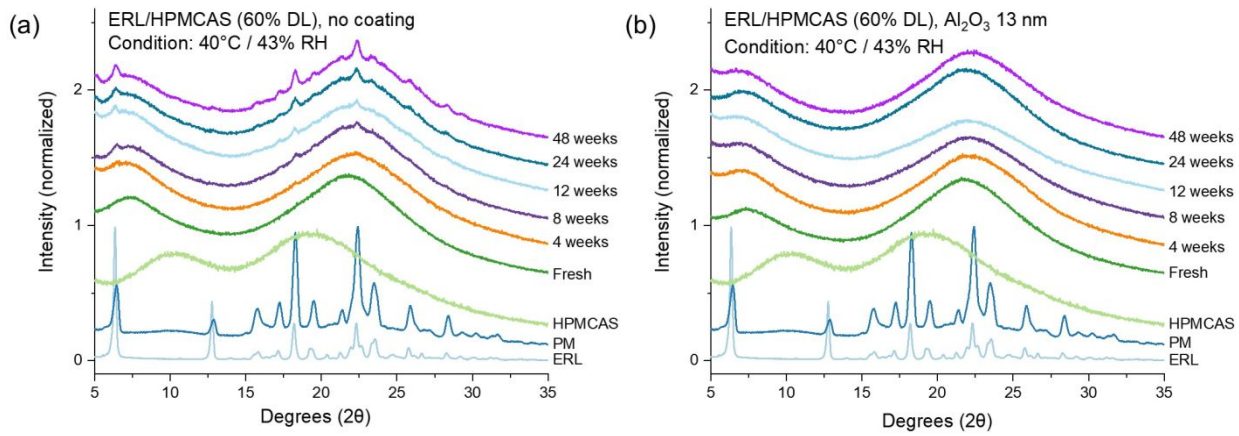

Figure S5. XRPD patterns of components and ASD systems over 48 weeks stability: ERL/HPMCAS (40℃/43% RH).

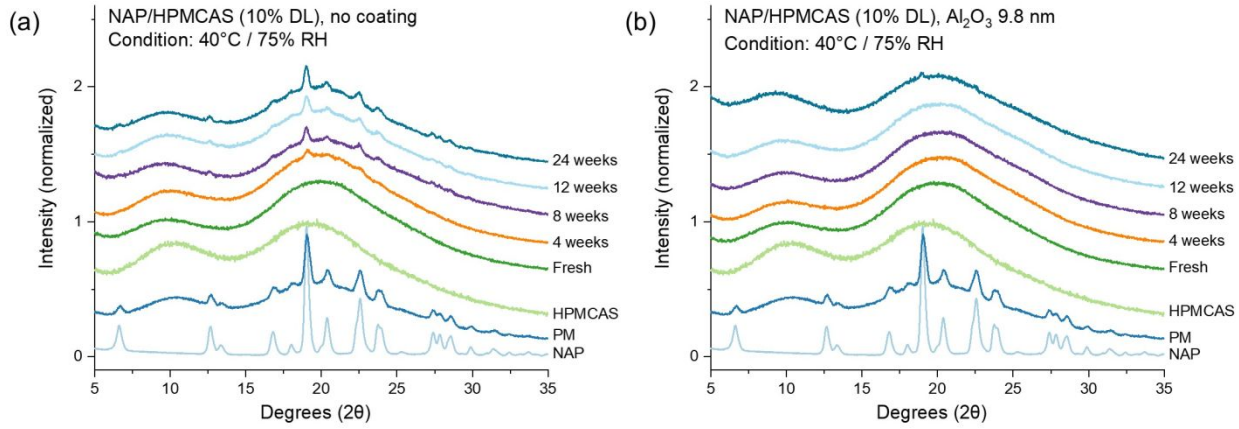

Figure S6. XRPD patterns of components and ASD systems over 24 weeks stability: NAP/HPMCAS (40℃/75% RH).

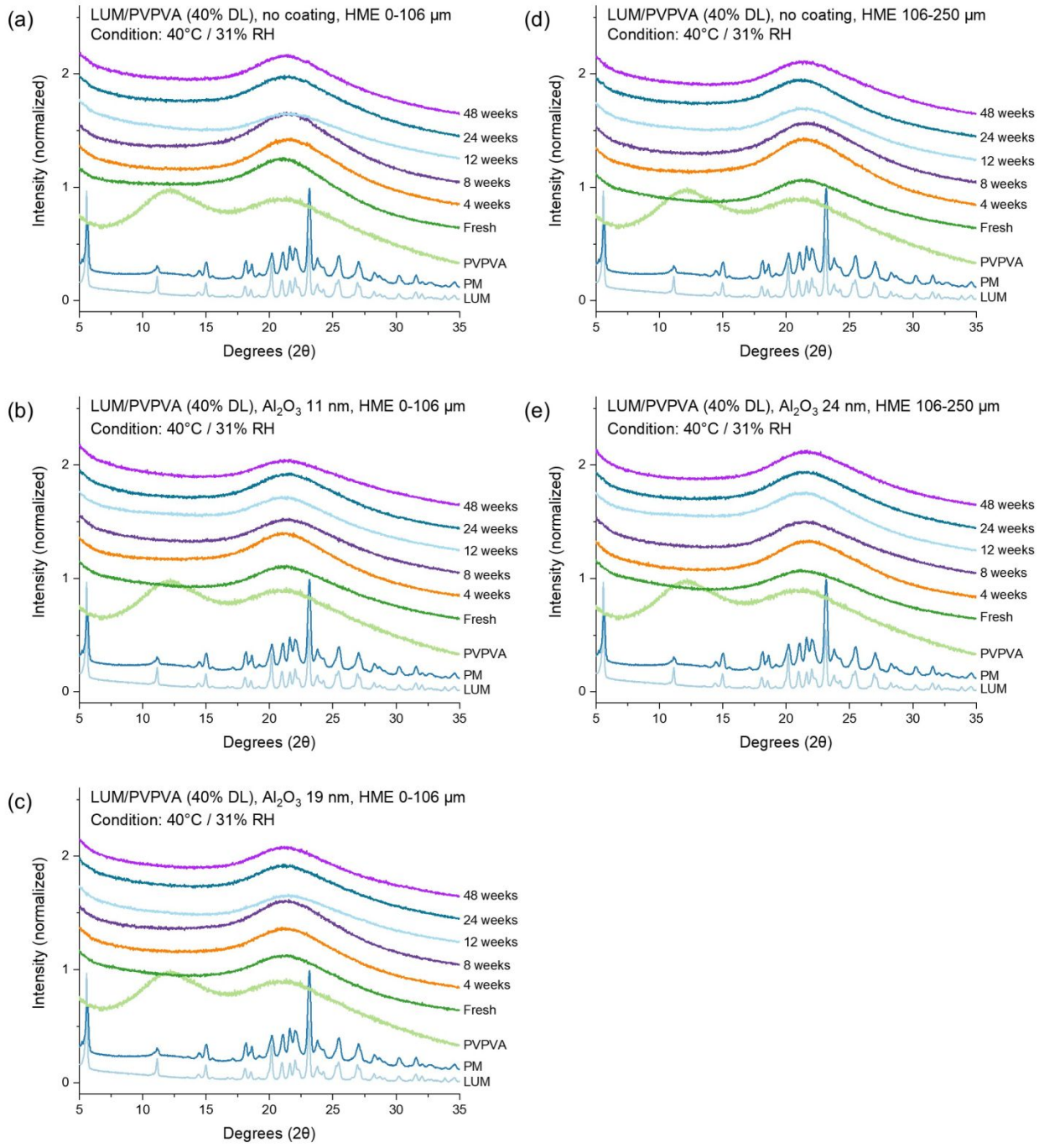

Figure S7. XRPD patterns of components and ASD systems over 48 weeks stability: LUM/PVPVA (HME, 40℃/31% RH).

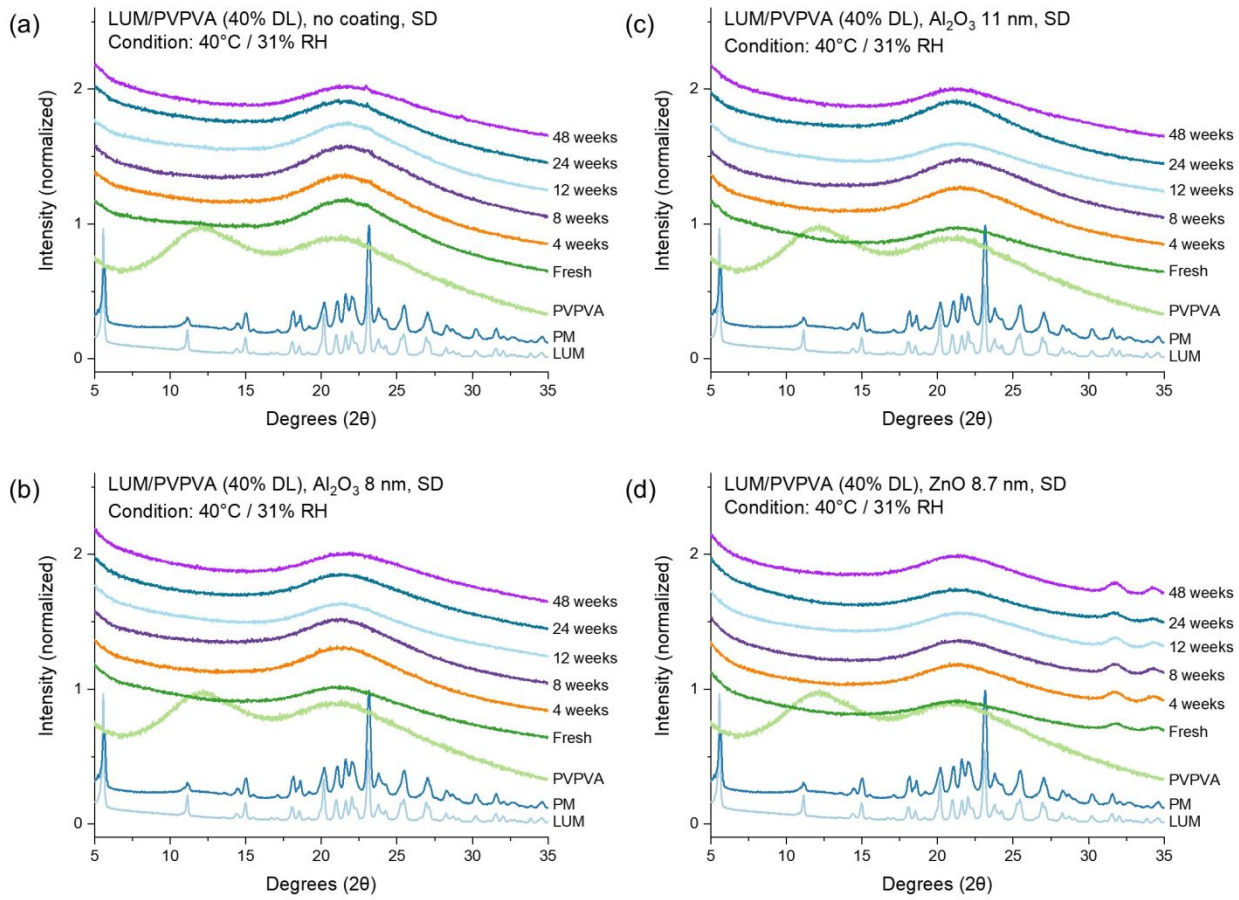

Figure S8. XRPD patterns of components and ASD systems over 48 weeks stability: LUM/PVPVA (SD, 40℃/31% RH).

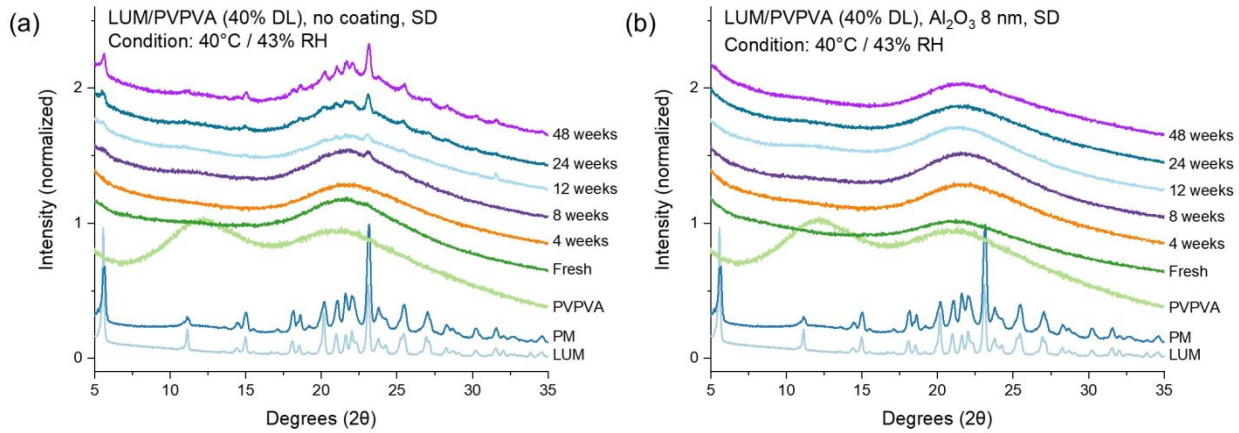

Figure S9. XRPD patterns of components and ASD systems over 48 weeks stability: LUM/PVPVA (SD, 40℃/43% RH).

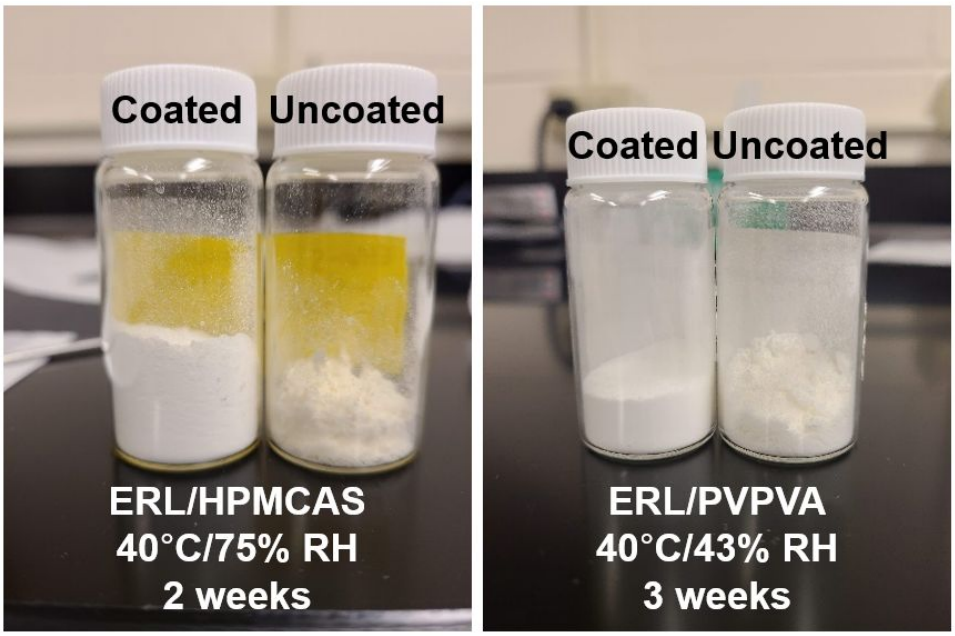

Figure S10. Images of ASD powders after several weeks of stability storage.

Amorphous Solid Dispersion Preparation

Table S2. Spray drying processing conditions

Formulation	Solvent System	Spray Solution Solids Content	Inlet Temperature, °C	Outlet Temperature, °C	Aspirator, m^3/h	Pump feed rate, mL/min
EH60	50/50 v/v Methanol/ Dichloromethane	10%	90	60	34.3	~12
EP50	50/50 v/v Methanol/ Dichloromethane	10%	105	68	34.7	~12
LP40-SD	50/50 v/v Ethyl acetate/ Dichloromethane	10%	95	65	35	~12

Table S3. Hot melt extrusion processing conditions

Formulation	Operating Temperature, °C	Screw Speed, rpm
NH10	160	200
LP40	150	200