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Porous fluorinated polyarylene ether nitrile as ultralow permittivity dielectrics used under

humid environment

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Sample	FPEN	Volume ratio of	$\mathrm{T}_{\mathrm{liquid}}$	T _{dry}
	contents	water/ethanoi		
F_1	24 wt%	100/0	250 μm	100 µm
F_2	22 wt%	100/0	250 µm	100 µm
F_3	20 wt%	100/0	250 µm	100 µm
F_4	18 wt%	100/0	250 µm	100 µm
F_5	16 wt%	100/0	250 µm	100 µm
F_6	14 wt%	100/0	250 μm	100 µm
F_7	14 wt%	80/20	250 μm	100 µm
F_8	14 wt%	60/40	250 μm	100 µm
F9	14 wt%	40/60	250 μm	100 µm
F_{10}	14 wt%	20/80	250 μm	100 µm
F ₁₁	14 wt%	0/100	250 μm	100 µm

Table S1. The fabrication parameters for porous FPEN films, the thickness of liquid porous FPEN films (T_{liquid}), and the thickness of the obtained dry porous FPEN films (T_{dry}).



Figure S1. GPC result of FPEN





Figure S3. TGA curve of FPEN



Figure S4. Stress-strain curve of FPEN film without porous structure prepared through the solution casting method.



Figure S5. The permittivity and dielectric loss of FPEN films without porous structure prepared through the solution casting method.



Figure S6. The fractured section morphology of porous FPEN films: (a) F_1 , (b) F_2 , (c) F_3 , (d) F_4 , (e) F_5 ; (f) F_6 .



Figure S7. SEM images of porous FPEN films surface: (a) F_1 , (b) F_2 , (c) F_3 , (d) F_4 , (e) F_5 , (f) F_6



Figure S8. AFM images of porous FPEN films: (a) F_1 , (b) F_2 , (c) F_3 , (d) F_4 , (e) F_5 , (f) F_6 .



Figure S9. (a) The measured permittivity and (b) the dielectric loss of porous FPEN films at 1 kHz with varied porosities.



Figure S10. The water contact angle (a) and water uptake rate (b) of PEN and FPEN films without porous structure prepared through the solution casting method.



Figure S11. The water uptake rate of porous FPEN films: (a) F_1 , F_2 , F_3 , F_4 , F_5 , F_6 ; (b) F_6 , F_7 , F_8 , F_9 , F_{10} , F_{11} .



Figure S12. The permittivity (a), dielectric loss (b) and the increment rate of permittivity (c) in 80% relative humidity at frequency range of 1~10⁶ Hz of PEN films and FPEN films without porous structure prepared through the solution casting method.



Figure S13. The increment rate of permittivity in 80% relative humidity of porous FPEN films.



Figure S14. The dielectric loss in 80% relative humidity at frequency range of 1~10⁶ Hz of porous FPEN films.