

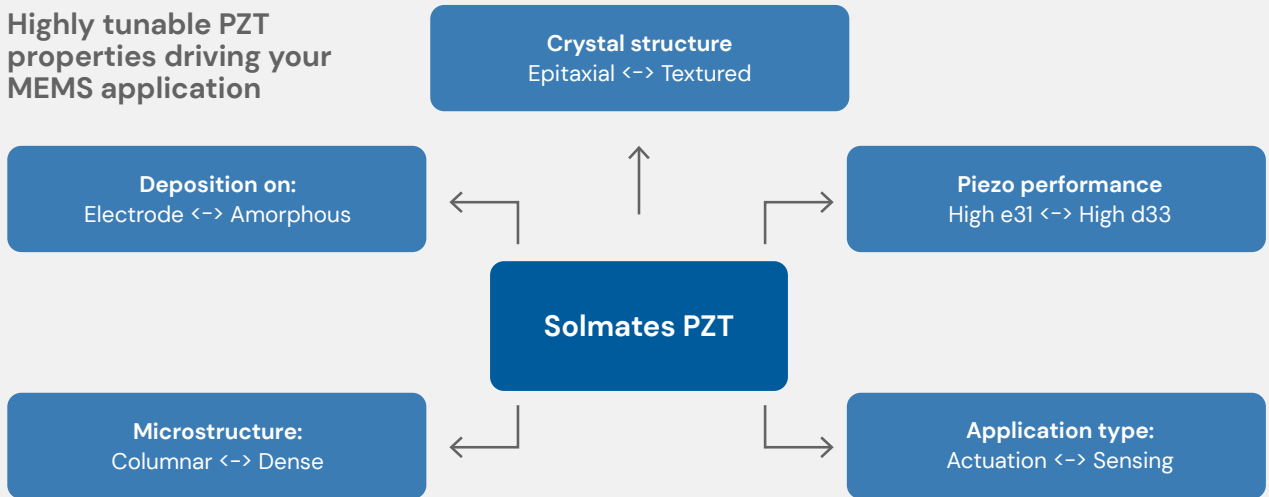
PZT for thin film piezo MEMS

Solmates Pulsed Laser Deposition process:

- High density Pb(Zr,Ti)O₃ (PZT) thin films
- Uniform deposition on wafers up to 200mm diameter
- High piezo performance as deposited, no poling or post anneal required

- High yield, stable performance, low fatigue
- Nucleation on metal, oxide or nitride thin film electrodes
- Successful demonstrators in acoustics, optical strain modulators, RF-MEMS, energy harvesters, micromirrors, and others

Highly tunable PZT properties driving your MEMS application

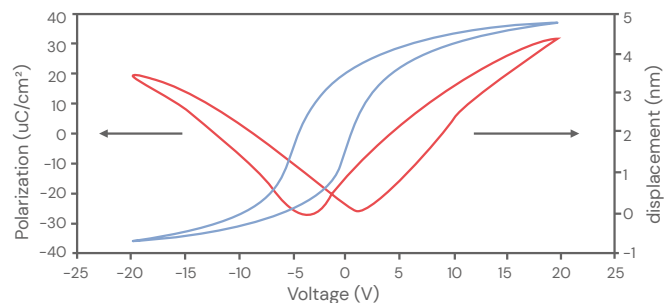


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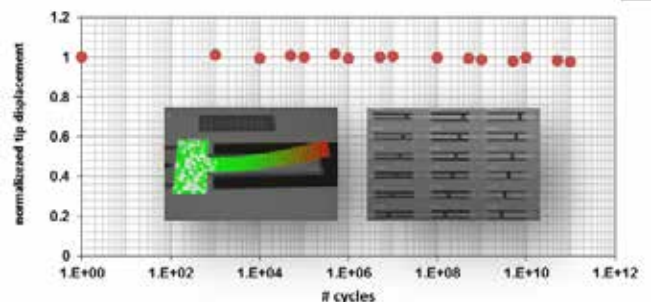
PZT process performance

d_{33}	> 200 pm/V
$e_{31,f}$	> 18 C/m ²
Breakdown	> 800 kV/cm
Permittivity	200 – 1800
No post anneal required PLD enables full oxide stack	

High displacement and polarization



Stable performance over many cycles



Global service network, proven track record and process development support for your manufacturing needs

Equipment

Substrate dimensions	Up to Ø300 mm
Substrate shape	Round and square
Laser	KrF excimer laser
Beam delivery	Complete integrated optics
Process temperature	RT – 800°C
Substrate temperature-uniformity	<2%
Process gasses	O ₂ , Ar, N ₂ – others on request (forming gas)
Particles	Active particle filtering technology

Process specifications

Thickness uniformity		
W / W		< 2 % 1s
WtW / RtR		< 1.5 % 1s
Composition uniformity		< 2 % 1s

Options

- Host interface
- Target library loadlock

Markets	Application / functionality	Materials
OLED & LED	Anti-reflection, TCO's, barriers, passivation	Al ₂ O ₃ , AZO, HfO ₂ , IGZO, ITO, MgO, Mg-ZnO, Ta ₂ O ₅ , ZnO, ZrO ₂
MEMS & NEMS	Sensing, actuation, acoustics	Al ₂ O ₃ , BiFeO ₃ , KNN, LaNiO ₃ , PbTiO ₃ , Pb(Zr,Ti)O ₃ , PMN-PT, SrRuO ₃ , LiNbO ₃ , ZnO, AlN, Sc:AlN, HfO ₂
CMOS & power IC	High-k, passivation, barriers, spintronics	AlN, Al ₂ O ₃ , CeO ₂ , HfO ₂ , MgO, PZT, SrTiO ₃ , TiN, ZrO ₂
Energy	SOFC, PV, batteries, thermoelectrics	YSZ, CIGS, Gd-CeO ₂ , ITO, (La,Sr)(Co,Fe)O ₃ , Li _x MnO ₂ , Li _x CoO ₂ , Na _x CoO ₂ , Zn _{1-x} Al _x O
Photonics	Electro-optics, IR-detection, waveguides, quantum computing, Pockels	Al ₂ O ₃ , BaTiO ₃ , ITO, LiNbO ₃ , PLZT, Y ₃ Fe ₅ O ₁₂ , ZnO
Memory	MRAM	BiFeO ₃ , CoFe ₂ O ₄ , CrO ₂ , LSMO, MnFe ₂ O ₄ , MnO
Conductors	Electrodes, reflectors, alloys, superconductors, metal-insulator transition, oxide electrodes	Ba(Bi, Pb)O ₃ , LaNiO ₃ , SrRuO ₃ , SrLaCuO ₄ , V ₂ O ₃ , Yba ₂ Cu ₃ O _{7-x} , ITO
Epitaxy	templates, superlattices, 2D-materials	CeO ₂ , GaN, LaAlO ₃ , MgO, SrTiO ₃ , TiN, YSZ, MoS ₂
RF & 5G	SAW, BAW, discrete devices (varactors, beam-steering, high-K)	AlN, BN, BaTiO ₃ , Ba1-xSrxTiO ₃ , Sc:AlN, LiNbO ₃

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