

Main Techniques in Fabricating PZT Thin Film

Sol-Gel
Sputtering
MOCVD (Metal Organic Chemical Vapor Deposition)
PLD (Pulsed Laser Deposition)

Advantages of Sol-Gel Method

Low cost
Easy facilities
Easily control the composition
Low residual stress

Main Steps of Sol-Gel Method

Sol solution preparation: PZT(53/47)
Substrate: Pt(111)/Ti/SiO₂/Si(100)
Spin coating
Annealing

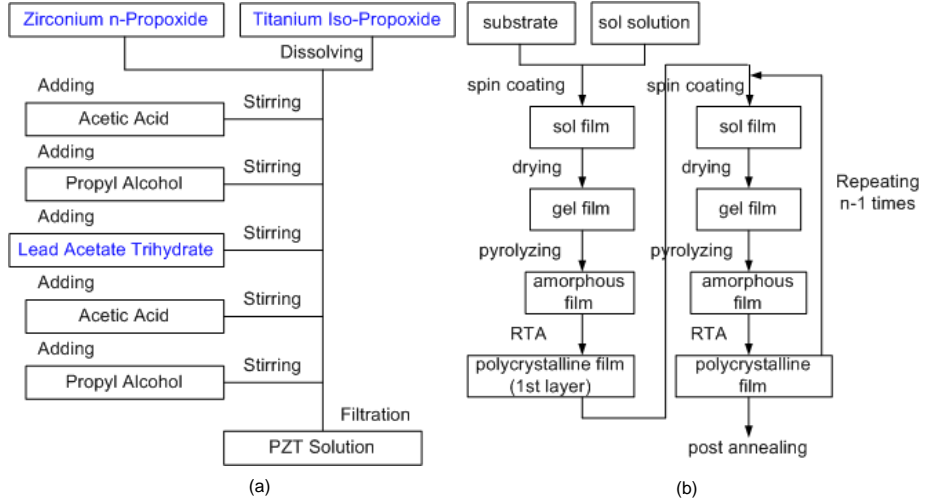


Fig 1. (a) PZT sol solution preparation process. (b) Sol-Gel fabrication process of PZT thin films.

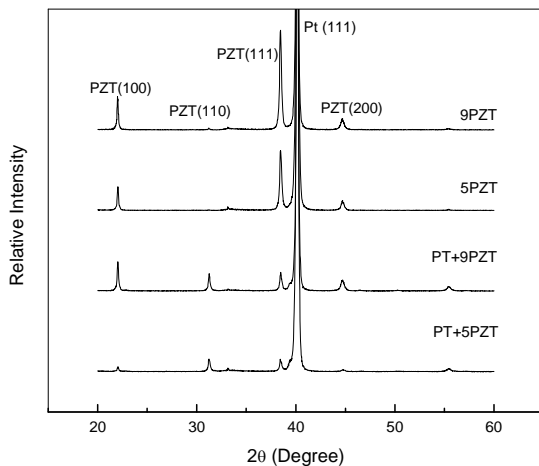


Fig 2. XRD patterns of the PZT thin films with different layers annealed at 700°C. The PZT films without seed layer have high (111) orientation, whereas the PZT films with PT seed layer have the (100) preferential orientation.

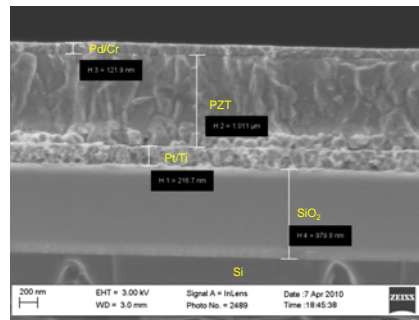


Fig 3. SEM cross-sectional microstructure of a 1µm PZT thin film. The multilayer structure also includes 1µm thermal oxide, 0.2µm Pt/Ti bottom electrode and 0.1µm Pd/Cr top electrode.

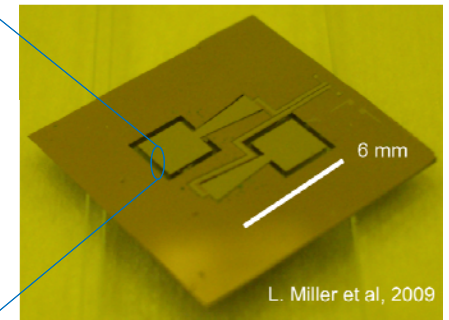


Fig 4. MEMS piezoelectric vibration energy harvesting device based on Sol-Gel PZT thin film.

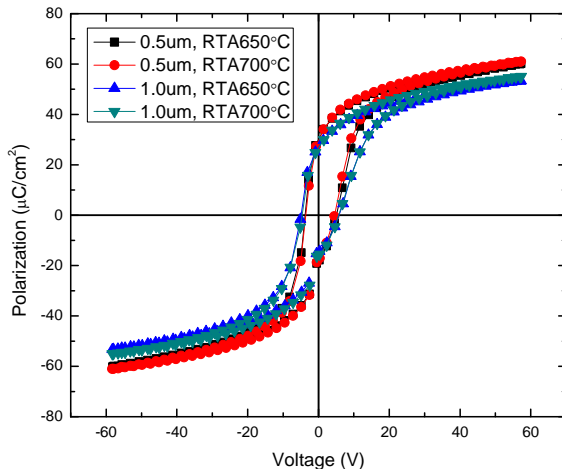


Fig 5. Ferroelectric hysteresis loops of PZT thin films annealed with different temperatures.

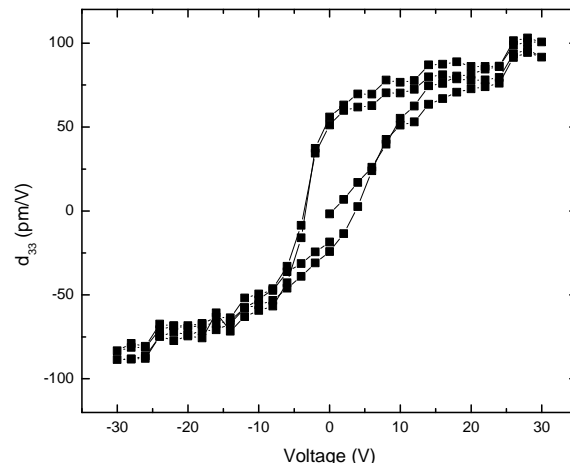


Fig 6. Piezoelectric coefficient d₃₃ versus applied voltage. The effective d₃₃ can reach higher than 100 pm/V.