Title
Fabrication and Characterization of PZT Thin Film for Energy Harvesting Application

Authors
Zhu, Yiping
Miller, Lindsay
Wright, Paul

Publication Date
2010

Fabrication and Characterization of PZT Thin Film for Energy Harvesting Application

Yiping Zhu, Lindsay Miller, Paul Wright

Berkeley BMI Manufacturing Micro Integration Microfabrication Institute

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/SiO_2/Si(100)
- Spin coating
- Annealing

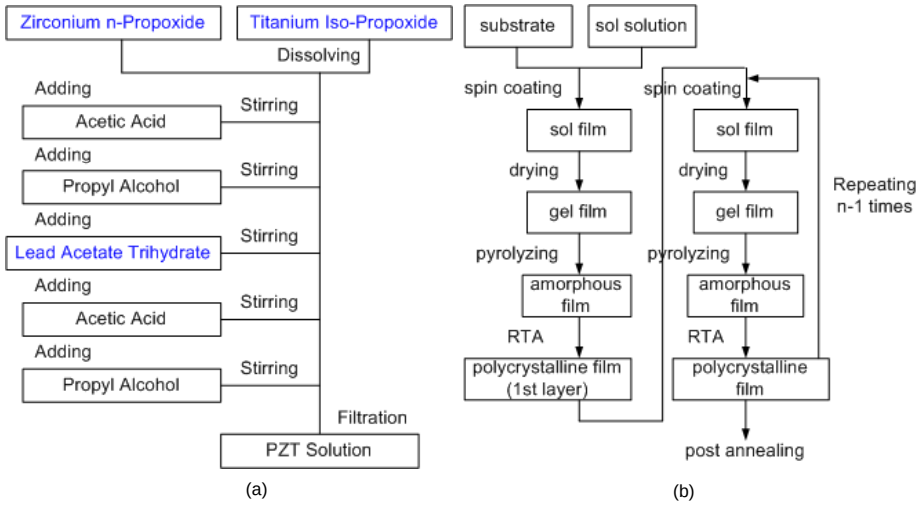

Fig 1. (a) PZT sol solution preparation process. (b) Sol-Gel fabrication process of PZT thin films .

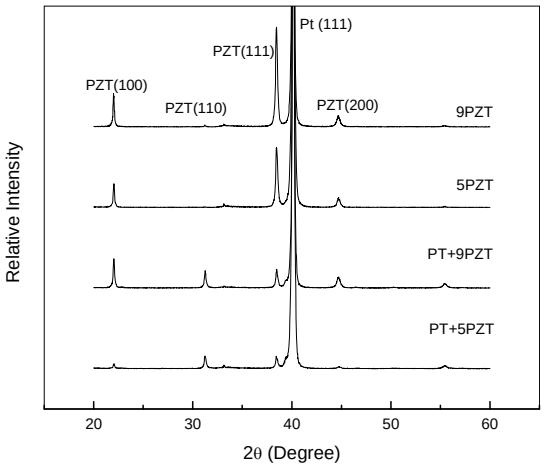

Fig 2. XRD patterns of the PZT thin films with different layers annealed at 700˚C. The PZT films without seed layer have high (111) orientation, whereas the PZT films with PT seed layer have the (100) preferential orientation.

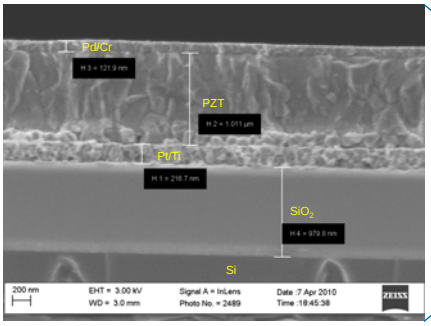

Fig 3. SEM cross-sectional microstructure of a 1um PZT thin film. The multilayer structure also includes 1um thermal oxide, 0.2um Pt/Ti bottom electrode and 0.1um Pd/Cr top electrode.

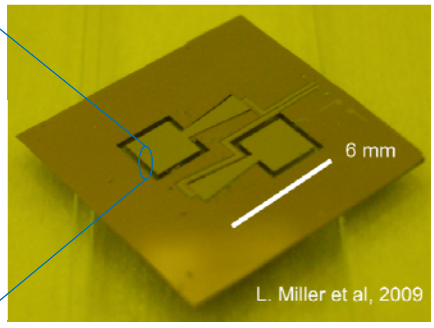

Fig 4. MEMS piezoelectric vibration energy harvesting device based on Sol-Gel PZT thin film.

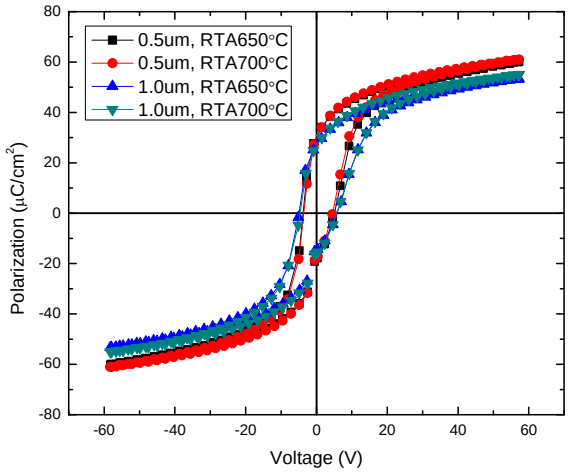

Fig 5. Ferroelectric hysteresis loops of PZT thin films annealed with different temperatures.

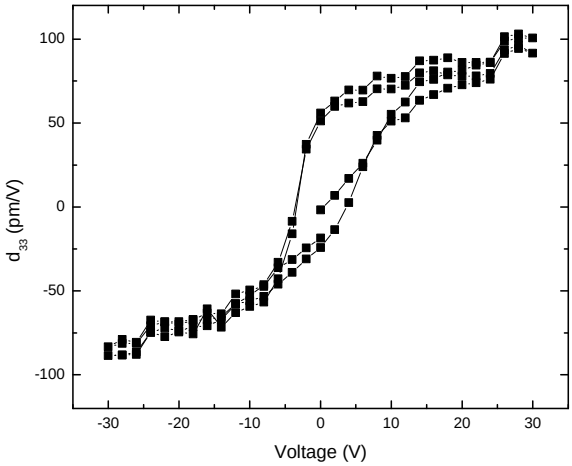

Fig 6. Piezoelectric coefficient d_{33} versus applied voltage. The effective d_{33} can reach higher than 100 pm/V.