DOUBLE ATMOSPHERIC LAYER SINTERING METHOD FOR PZT BASED MATERIALS

IITM Technology Available for Licensing

Problem Statement

- Lead-based ferroelectric materials, such as lead zirconium titanate (PZT), are widely used in various applications due to their superior properties, but face challenges during sintering processes where lead evaporates as PbO, affecting material properties.
- Current methods for sintering PZT bulk materials, including conventional techniques and advanced methods like pulsed laser deposition (PLD), struggle to prevent lead loss at high temperatures, limiting the material's performance and reliability.
- There is a need for a sintering method that can efficiently prevent lead evaporation during the sintering process, thereby enhancing the properties and reliability of PZT.

Intellectual Property

- IITM IDF Ref. **1498**
- **IN 364983 - Patent Granted**

Technology Category/ Market

Category- Advanced Materials and Ceramics
Applications - Ultrasonic Transducers, Sensors and Actuators, Energy Harvesting
Industry - Electronics Manufacturing

Market - Lead Zirconate Titanate (PZT) market is projected to reach US$ 765 million by 2032, expanding at a rapid **CAGR of 8%.**

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

Research Lab

Prof. Sankaranarayanan V
Prof. K. Sethupathi
Prof. M. S. Ramachandra Rao
Dept. of Physics

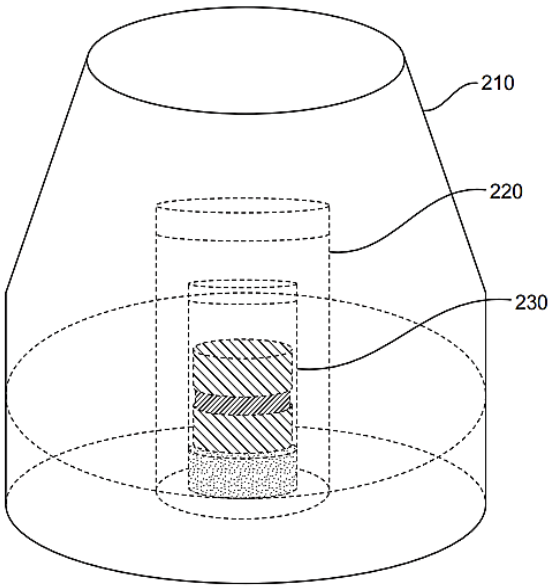

FIG. 1. Schematic diagram for Double Atmospheric Layer Protected Sintering method (DALPS) set up. The DALPS setup includes a crucible comprising an outer chamber 210, a middle chamber 220, and an inner chamber 230 placed concentric to one another.

Technology

- The invention relates generally to **a sintering method and in particular to preparing lead zirconium titanate bulk materials.**

Method

- **Novel Sintering Method:** The disclosed method introduces a novel approach to sintering lead zirconium titanate (PZT) materials, utilizing a crucible with multiple chambers and specific compositions of PbO in each chamber to prevent lead loss during heating, thereby enhancing material properties and reliability.
- **Enhanced Material Performance:** By controlling the composition and sintering process parameters, the resulting PZT material exhibits desirable properties such as high polarization, low dielectric loss, and high Curie temperature, making it suitable for various applications in dielectric and ferroelectric devices.

CONTACT US
Dr. Dara Ajay, Head - TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

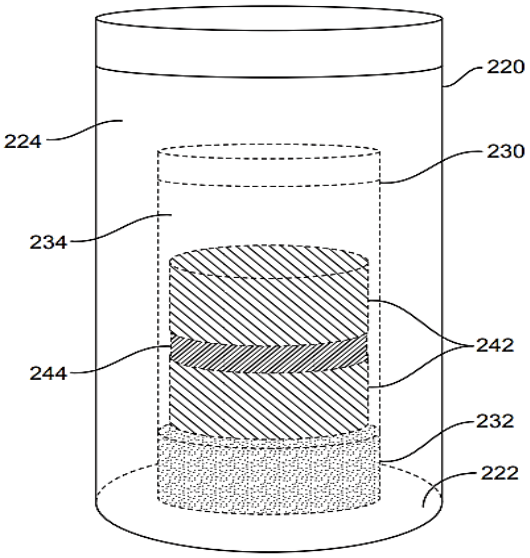

FIG. 2 Shows a schematic diagram showing the inner chamber.

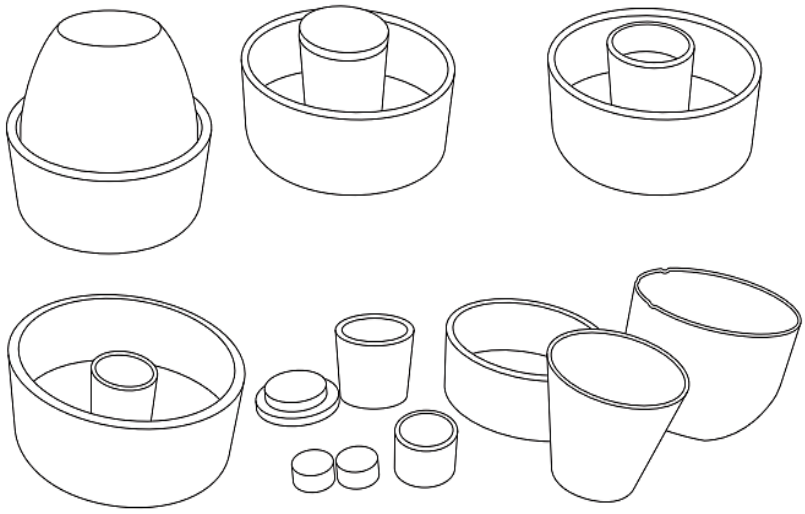

FIG. 3. illustrates the alumina crucibles that form three concentric chambers.

Key Features / Value Proposition

1. Advanced Sintering Methodology:

- Introduces a novel sintering method for lead zirconium titanate (PZT) materials, optimizing PbO compositions to prevent lead loss during heating.

2. Tailored Material Properties:

- Enables precise control over PZT material properties such as polarization, dielectric constant, and Curie temperature, catering to diverse application requirements.

3. High Performance Dielectrics:

- Offers PZT materials with exceptional dielectric properties, including low dielectric loss and high dielectric constant, ensuring efficient energy storage and signal transmission.

4. Enhanced Ferroelectricity

- Facilitates the development of PZT materials with superior ferroelectric characteristics, leading to high polarization and remnant polarization for improved device performance.

5. Temperature Resilience:

- Provides PZT materials with high Curie temperature, enabling operation in broad temperature ranges, enhancing reliability in harsh environmental conditions.

6. Versatile Applications

- Enables the creation of PZT materials suitable for a wide range of applications, including sensors, actuators, transducers, and memory devices

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Dr. Dara Ajay, Head- TTO
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IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719