IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

LANTHANUM DOPING OF CERIA ABRASIVE TO OBTAIN ROBUST CMP POLISH RATES

IITM Technology Available for Licensing

Problem Statement

- To achieve planarization and polishing of wafer surfaces, Chemical Mechanical Polishing (CMP) is an essential technique in semiconductor production.
- **Traditional CMP processes using abrasive slurries have limitations, including impurities, defects, and difficulty controlling material removal rates.**
- The development of next-generation nanoparticle abrasives holds promise for improving CMP performance, reducing defects, and achieving greater control over material removal.
- **Researchers are exploring using ceria nanoparticles and other advanced abrasives to enhance CMP processes** and meet the demands of advanced semiconductor technology.

Intellectual Property

- IITM IDF Ref. **1086**
- **IN 426681 - Patent Granted**

Technology Category/ Market

Category- Chemical Mechanical Planarization Process

Applications - Used for the polishing of silicon dioxide and silicon nitride wafers during the production of integrated circuits (ICs).

Industry - Semiconductor Manufacturing.

Market- Global chemical mechanical planarization market size is expected at $5.82 Bn by 2027 at a growth rate of 7.9%.

TRL (Technology Readiness Level)

TRL - 3 , Technology concept formulated.

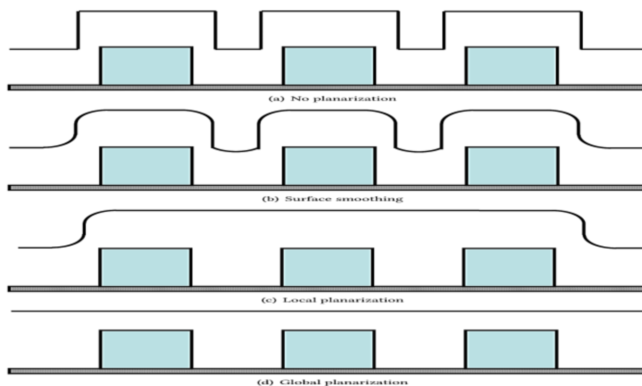

FIG. 1. Different forms of polishing.

Technology

1

- **The CMP method involves using a fixed abrasive pad loaded with ceria, which contains less than 1 wt% lanthanum along with additives like L-proline.**

2

- **The ceria abrasive can be either nano particles or micro particles, providing flexibility in particle size selection based on process requirements.**

3

- **The ceria is a combination of cerium and oxygen, while the lanthanum present in ceria is in the form of lanthanum oxide.**

4

- **The polishing slurry used in the process has a pH value of 7 and is designed to non-selectively enhance the polish rate of silicon dioxide and silicon nitride.**

5

- **This CMP method offers a controlled and efficient approach for planarization of silicon wafers, especially in semiconductor manufacturing, with the potential for improved performance and reduced defects.**

Research Lab

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Key Features / Value Proposition

1. **Enhanced CMP Performance.**
2. **Nano or micron size abrasive ceria particles can be used.**
3. **Applicable with most of the amino acids as additives.**
4. **Non-Selective Polishing of both oxide and nitride wafers.**
5. **Cost-Efficiency and Productivity.**

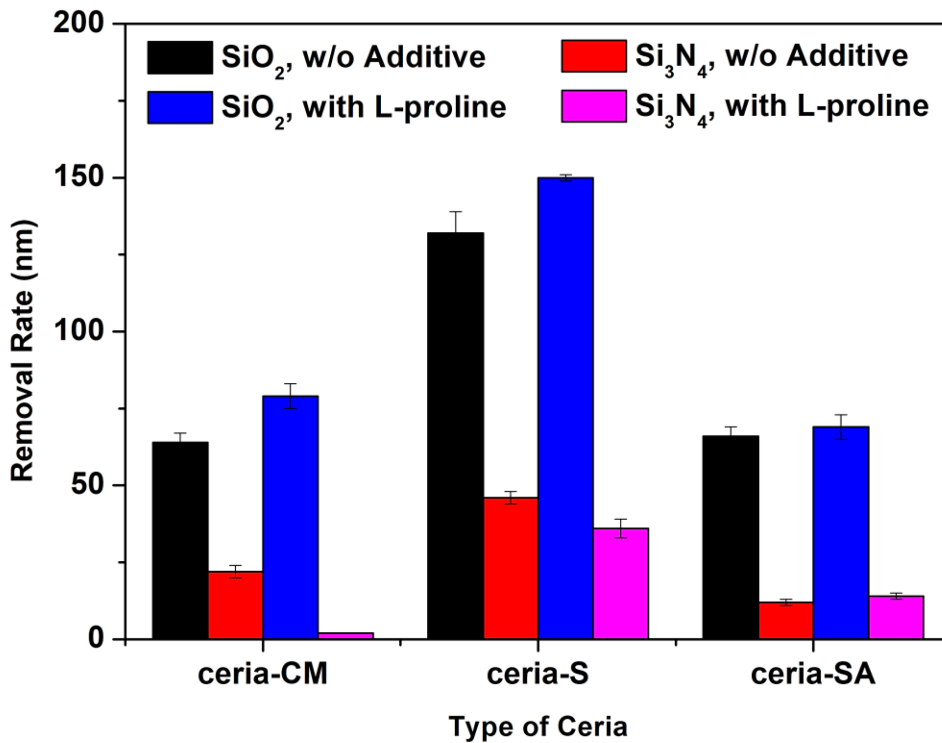

FIG. 2. The experiments are repeated atleast thrice and the average values along with the standard deviation are reported.

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