NARASIMHARAO V AVVARU

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Personal Details:
Date of Birth : 5th Jul, 1988
Nationality : Indian
Marital status : Married

EDUCATION

IIT Hyderabad, Telangana, INDIA **2014-2019**
Ph.D.,Department of Physics
- **Advisor:**Prof. Prem Pal
- **CGPA:**9.38/10

IIT Madras, Tamil Nadu, INDIA **2011-2013**
M.Tech., Solid State Technology
- CGPA: 7.72/10

Andhra University,Andhra Pradesh, INDIA **2008 - 2010**
M.Sc., Physics
- CGPA: 7.22/10

Acharya Nagarjuna University, Andhra Pradesh, INDIA**2005-2008**
B.Sc., MPCs (Maths, Physics, Chemistry)
- CGPA: 69.5 %

HONORS AND AWARDS

- **Excellence in Research Award,** IIT Hyderabad, 2018
- **Excellence in Research Award,** IIT Hyderabad, 2017
- **Joint CSIR-UGC Exam for Eligibly for Lectureship (NET) -2012**
- **APSET-2012**(Andhra Pradesh) in Physics
- **GATE-2011**(INDIA) in Physics with 83 rank
- **JEST-2011** (INDIA) in Physics with 119 rank
- **JEST-2014** (INDIA) in Physics with 119 rank

RESEARCH INTERESTS

- Microfabrication, Micromachining, MEMS devices
- Thin film deposition

RESEARCH EXPERIENCE

IIT Hyderabad, Telangana, INDIA
Ph.D. Scholar,Department of Physics,2014-2019

Main objectives of PhD work

- Investigation of high-speed silicon wet bulk micromachining in KOH-based solutionfor applications in MEMS fabrication. Fabrication of microstructure for MEMS applications (cantilevers for sensors, mesa structures for accelerometer,cavities, 45 degrees mirrors,silicon solar sell application, microneedles for drugs delivery, etc.).

- Determination of precise crystallographic direction on silicon wafer surface using self-aligned pre-etched patterns.

RCI, DRDO,Telangana, INDIA
Research Associate, MEMS lab, 2019-2020

- The research work at RCI was focused on silicon wet bulk micromachining for the development of MEMS based inertial sensors.

IIT Madras, Chennai, INDIA
M Tech project, 2012-2013

- Synthesis, Study of structural & Magnetic properties of Transition metal (TM)-Boronto form core-shell structure nanoparticles by novel synthesis method for high frequency applications.

TEACHING EXPERIENCE

Faculty in physics, RGUKT University, A.P, 2021 –present.
Faculty in physics, Sri Mitttapallli College of Engineering, 04-01-2020 to 10-06-2021
Faculty in physics, Sri Mitttapallli College of Engineering, 02-06-2013 to 14-08-2014

TECHNICAL EXPERIENCE

Software Tools

- Intellitech
- Comsol
- Clewin5
- Chemdraw Ultra
- Matlab
- Origin, C
- Solid Edge

Microfabrication skills

- Wafer Cleaning, Photolithography, RF/DC Sputtering, Reactive Ion Etching, Wet Isotropic and Anisotropic Etching, Bulk Micromachining Process, Mask design

Instruments:

- **Characterization tools:**Scanning electron microscopy (SEM), 3D laser scanning microscopy, Ellipsometry, Optical microscopy,Laser doppler vibrometry, Non-contact optical profilometry

- **MEMS Fabrication tools:** Spin coater, Mask aligner, Wet etching and Reactive ion etching system
- **Thin film deposition tools:** RF & DC magnetron sputtering system

POSITION OF RESPONSIBILITY

- Technical trainer of wafer cleaning, photolithography and wet etchingin TEQIP Workshop on MEMS & NEMS (Design and Fabrication) in 2016 &2018 at Hyderabad.
- **Equipment operator**:Scanning electron microscopy (SEM), 3D laser scanning microscopy, Ellipsometry, Optical microscopy.
- Half Time Teaching Assistantship in the Department of Physics As part of the Academics Couse.
- Participate in Electron Microscopy: Basics and Applications training by GIAN in 2016 at IIT Hyderabad.

PUBLICATIONS

1. **A. V. Narasimha Rao**, P. Pal, A. K. Pandey, V. Swarnalatha, P. K. Menon, H. Tanaka, and K. Sato, "Aging effects of KOH + NH_2OH solution on the etching characteristics of silicon", ECS Journal of Solid State Science and Technology, 8(11), P685-P692, 2019.
2. **A. V. Narasimha Rao***, V. Swarnalatha, A. K. Pandey, S. S. Singh and P. Pal, "Determination of precise crystallographic directions on Si{111} wafers using self-aligning pre-etched pattern", Micro and Nano Systems Letters,6(1), 4, 2018.
3. **A. V. Narasimha Rao***, V. Swarnalatha, A. Ashok, S. S. Singh and P. Pal*, "Effect of NH_2OH on etching characteristics of Si{100} in KOH solution", ECS Journal of Solid State Science and Technology, 6(9), P609-P614, 2017.
4. **A. V. Narasimha Rao**, V. Swarnalatha and P. Pal*, "Etching characteristics of Si {110} in 20 wt% KOH with addition of hydroxylamine for the fabrication of bulk micromachined MEMS", Micro and Nano Systems Letters, 5(1), 23, 2017.
5. **A. V. Narasimha Rao***, V. Swarnalatha and P. Pal, "Effect of Surfactant and Alcohol Additives on Etching Characteristics in Aqueous Potassium Hydroxide Solutions", ECS Transactions, 77(11), 1761-1769, 2017.
6. S. S. Singh, **V. N. Avvaru**, S. Veerla, A. K. Pandey and P. Pal, "A measurement free pre-etched pattern to identify the <110> directions on Si {110} wafer", Microsystem Technologies, 23(6), 2131-2137, 2017.
7. V. Swarnalatha, **A. V. Narasimha Rao**, A. Ashok, S. S. Singh and P. Pal, "Modified TMAH based etchant for improved etching characteristics on Si {1 0 0} wafer", Journal of Micromechanics and Microengineering, 27(8), 085003, 2017.
8. V. Swarnalatha, **A. V. Narasimha Rao** and P. Pal, "Effective improvement in the etching characteristics of Si{110} in Low concentration TMAH solution", Micro and Nano Letters, 13(8), 1085-1089, 2018.
9. V. Swarnalatha, **A. V. Narasimha Rao** and P. Pal. "Silicon anisotropic etching in ternary solution composed of TMAH+ Triton+ NH_2OH", ECS Transactions, 77(11), 1737-1745, 2017.
10. V. Swarnalatha, P. Pal, A. K. Pandey, **A. V. Narasimha Rao**, Y. Xing, H. Tanaka and K. Sato, "Systematic and parametric analysis of etching characteristics of Si {111} in modified TMAH solution", Micro & Nano Letters, 15(1), 52-57, 2020.

11. P. K. Menon, **A. V. Narasimha Rao**, A. L. Murthy, A. K. Pandey and P. Pal,"High speed etching of silicon in KOH+ NH_2OH solution at lower temperatures for the fabrication of through holes in silicon wafer", Micro & Nano Letters, 1-6, 2020.
12. V. Swarnalatha, K. T. Vismaya, **A. V. Narasimha Rao**, P. Pal, A. K. Pandey, H. Tanaka and K. Sato, "Etching mechanism behind the high-speed etching of silicon in NH_2OH-added alkaline solutions." IEEJ Transactions on Sensors and Micromachines, 140(1), 24-30, 2020.
13. P. K. Menon, A. Ashok, **A. V. Narasimha Rao**, A. K. Pandey and P. Pal,"Effect of concentration change of 0.1% triton added 25 wt% TMAH during fabrication of deep cavities with mesa structures in SOI wafer", Microelectronic Engineering, 111323, 2020.
14. P. Pal, V. Swarnalatha, **A. V. Narasimha Rao**, A. K. Pandey, H. Tanaka and K. Sato. "High speed silicon wet anisotropic etching for applications in bulk micromachining: a review", Micro and Nano Systems Letters, 9(1), 1-59, 2021.

CONFERENCE PROCEEDINGS

1. **A. V. Narasimha Rao***, P. Pal, "Micromachining Characteristics of Triton X-100 added NH_2OH+KOH", 22th International Workshop on Physics of Semiconductor Devices (22th IWPSD), IITM, Chennai, India, 2023.
2. **A. V. Narasimha Rao***, P. Pal, "Effect of IPA on Micromaching Characteristics of Silicon in KOH-Based Solution", Microactuators, Microsensors and Micromechanisms, MAMM 2022, Mechanisms and Machine Science, Springer, 126, 281-289, 2022.
3. **A. V. Narasimha Rao**, V. Swarnalatha, A. K. Pandey and P. Pal, "Microstructures with protected convex corners in modified KOH solution exhibiting high-speed silicon etching",Sensor Materials, Processing & Fabrication Session, IEEE Sensors 2018, Delhi, India, 2018.
4. **A. V. Narasimha Rao***, P. Pal, A. K. Pandey, P. K. Menon, H. Tanaka and K. Sato,''High Speed Silicon Wet Bulk Micromachining of Si {111} in KOH Based Solution'', In 2020 Symposium on Design, Test, Integration & Packaging of MEMS and MOEMS (DTIP), IEEE,1-5, 2020.
5. V. Swarnalatha, **A. V. Narasimha Rao** and P. Pal, "Study of fast etching of silicon for the fabrication of bulk micromachined MEMS structures", World Academy of Science, Engineering and Technology, International Journal of Chemical, Molecular, Nuclear, Materials and Metallurgical Engineering, 11(12),777-780, 2017.
6. V. Swarnalatha, **A. V.Narasimha Rao** and P. Pal, "Silicon etching characteristics in modified TMAH solution", 19th International Workshop on Physics of Semiconductor Devices (19th IWPSD), IITD, New Delhi, India, 2017.
7. B. S. Srinivas, V. Swaranalatha, **A. V. Narasimha Rao** and P. Pal, "Study of cutting-edge AFM modalities and SEM techniques in determining surface parameters of Si {111} wafer",19th International Workshop on Physics of Semiconductor Devices (19th IWPSD), IITD, New Delhi, India, 2017.

PRESENTATIONS

1 **Oral Presentation:** Micromachining Characteristics of Triton X-100 added NH_2OH+KOH, 22th International Workshop on Physics of Semiconductor Devices (22th IWPSD), IITM, Chennai, India, 2023.

2 **Oral Presentation:** Effect of IPA on Micromaching Characteristics of Silicon in KOH-Based Solution", Microactuators, Microsensors and Micromechanisms, MAMM 2022, Mechanisms and Machine Science, Springer, 126, 281-289, 2022.

3 **Oral Presentation:**Advancement in Materials Science and Physics, November 19-20, 2018, Manipal University Jaipur, Jaipur, India, 2018.
4 **Poster Presentation:** Sensor Materials, Processing & Fabrication Session, IEEE Sensors 2018, October 28-October 31, IITD, Delhi, India, 2018.
5 **Poster Presentation:** Asia-Pacific Conference on Transducers and Micro-Nano Technology (APCOT), June 24-June 27, Daegu Korea, 2018.
6 **Poster Presentation:** 231st The Electrochemical Society, Meeting, May 28-June 1, 2017, New Orleans, USA.
7 **Poster Presentation:**19th International Workshop on Physics of Semiconductor Devices (19th IWPSD), IITD, New Delhi, India, 2017.
8 **Oral Presentation:** 1st National Conference on Recent Advancement in Electronics (NCRAE-2016), January 22-23,Hyderabad, India, 2016.
9 **Poster Presentation:** 18th International Workshop on the The Physics of Semiconductors Devices (IWPSD-2015), December 11-15,IISc, Bangalore, India, 2015.

REFERENCES

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