Kevin Jacob

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Postdoctoral researcher, Iowa State University

Research Interests:

- Processing-microstructure-property relationships in extreme environment alloys
- Advanced microscopy (TEM/APT) and in-situ mechanical testing
- Radiation-tolerant and high-temperature structural materials
- Small-scale mechanical testing and nanomechanics
- Phase transformations in thin films

Publications:

1. **K Jacob**, Kim, H., Lyu, Z., Tiarks, J., Argibay, N., Lavender, C.A., McCoy, M., Sornin, D., Lewandowski, J.J., Anderson, I., and Maloy, S.A. "Processing-Microstructure-Property Relationships in (Yitria) Oxide-Dispersoid-Strengthened (ODS) 14YWT Steels: Insights from Orientation Resolved Nanoindentation", *Acta Materialia*, 2026, under review http://dx.doi.org/10.2139/ssrn.5669875

2. S Najmabad, **K Jacob**, S Pathak, C Bronkhorst, M Knezevic, "Orientation- and temperature-dependent slip activity in tantalum." *International Journal of Mechanical Science*, 2026. https://doi.org/10.1016/j.ijmecsci.2026.111839

3. **K Jacob,** Atale, N.P., Shimak, E., Wanni, J., Knezevic, M., Thoma, D.J., Bronkhorst, C., and Pathak, S. "Correlating Microstructural Hierarchy and Nanoindentation Response in Quenched and Tempered Low-Carbon Steel." *Materials Characterization*, 2026. 10.1016/j.matchar.2026.116597

4. Lyu, Z., **K Jacob**, Naorem, R., Anderson, I., "In-situ Synchrotron X-ray Investigation of Phase Evolution in Gas Atomized Powder Enabling Manufacturing of Nanoscale Oxide-Dispersion Strengthened Ferritic Steels", *Scripta Materialia*, 2026 https://doi.org/10.1016/j.scriptamat.2026.117357.

5. **K. Jacob**, D. Yadav, S. Dixit, A. Hohenwarter, B. Nagamani, High pressure torsion processing of maraging steel 250 : Microstructure and mechanical behaviour evolution, Mater. Sci. Eng. A. 802 (2021) 140665. https://doi.org/10.1016/j.msea.2020.140665.

6. **K. Jacob**, A. Roy, M.P. Gururajan, B.N. Jaya, Effect of Dislocation Network on Precipitate Morphology and Deformation Behaviour in Maraging steels: Modelling and Experimental Validation, Materialia. 21 (2022) 101358. https://doi.org/10.1016/j.mtla.2022.101358

7. **K Jacob**, H Khanchandani, S Dixit, BN Jaya, Suppression of Reverted Austenite in Cold-Rolled Maraging Steels and Its Impact on Mechanical Properties, Metallurgical and Materials Transactions A, 2023. https://doi.org/10.1007/s11661-023-07219-1

8. **K. Jacob**, HP Sahasrabuddhe, S. Dixit, A. Hohenwarter, B. Nagamani. Micro-mechanisms of failure in nano-structured maraging steels characterised through *in-situ* mechanical tests, Nanotechnology, 2022. 10.1088/1361-6528/ac952d

9. E DeMeyere, Cristian U, **K Jacob**, E Viray, K Estrada, H Huang, R Naorem, G Ouyang, A Kustas, V Vasudevan, N Dahotre, T Scharf, N Hackworth, W Oates, B Krick, and Nicolas Argibay. "Uniaxial Tensile Mechanical Properties from a Scratch on Ultrafine Grained Tungsten". *Proceedings of Royal Society A*, 2026 https://doi.org/10.1098/rspa.2025.0838

10. O Olanrewaju, M Kumar, **K Jacob**, C Bronkhorst, N Chen, S Najmabad, M Knezevic, S Pathak, "Statistics of BCC Tantalum Sub-Granular Elastic-Plastic Behavior using Spherical Nanoindentation". *Mechanics of Materials*, 2026

11. Supakul, S., **K Jacob**, Tucker, G.J, Pathak, S, "Microstructure and Mechanical Properties of Ti_2AlC/Ti

Max/Metal Nanolaminates". *Surface and Coatings Technologies*, Under review 2026 http://dx.doi.org/10.2139/ssrn.5085266

12. **K. Jacob**, S. Dixit, B.N. Jaya, Modelling the Strengthening and Softening Mechanisms in Maraging Steel 250, in: Adv. Struct. Integr., Springer, Singapore, 2022: pp. 357–364. https://link.springer.com/chapter/10.1007/978-981-16-8724-2_33.

13. BN Jaya, NG Mathews, AK Mishra, S Basu, **K Jacob**. Non-conventional small scale testing of materials. Journal of Indian Institute of Science, 2022. https://doi.org/10.1007/s41745-022-00302-3

Patent:

I. Anderson, J. Tiarks, S. Pathak, **K. Jacob**, Z. Lyu, "Alloy Powder Compositions for Gas Atomization Reaction Synthesis to Make Oxide Dispersion Strengthened Alloys," U.S. Utility Patent Application (filed, pending), Iowa State University Research Foundation (ISURF) Ref. No. 5715, filed 2025, pending.

Work Experience and Education:

Iowa State University, Ames — **Iowa, USA**
Post Doctoral Researcher — February 2023 – Present
Materials Science and Engineering
Advisor: Dr. Siddhartha (Sid) Pathak
Research focus: deformation mechanisms and phase transformations in advanced structural materials using nanomechanical testing and advanced microscopy.

Key Contributions

- Developed a **potential nuclear fusion first wall material** in the form of a modified 14YWT ODS steel through GARS and thermomechanical processing; investigated processing-**property-microstructure correlation** through HR-TEM, orientation resolved nanoindentation mapping and nanomechanical testing.
- Investigated **pseudomorphic phase transformation in Mg-Nb nanolaminates** using TEM and in-situ SEM nanomechanical testing.
- **High-strain-rate indentation** and micropillar compression experiments to study void nucleation and failure mechanisms
- Studied non-Schmid effects in BCC materials using **temperature-dependent nano mechanical deformation tests on tantalum** through cryogenic nanomechanical testing.
- Contributed to the formulation and writing of multiple funded **DOE and user proposals** for access to synchrotron facilities at Argonne National Laboratory and the CINT facility at Los Alamos National Laboratory.

Indian Institute of Technology Bombay, Mumbai — **Maharashtra, India**
Doctor of Philosophy — July 2017 – March 2023
Project: Effect of deformation processing on mechanical and precipitation behaviour of Maraging steels
Metallurgical and Material Science Engineering
Advisor: Dr. Nagamani Jaya Balila
Research focus:

- Severe plastic deformation of maraging steels using **high pressure torsion (HPT)** and cold rolling
- Precipitation behavior and dislocation-precipitate interactions during aging and deformation characterized through APT and TEM analysis
- In-situ SEM mechanical testing and optical DIC measurements to measure tensile and fracture properties

National Institute of Technology Rourkela **Odisha, India**
Masters in Technology (M.Tech), July 2015 – June 2017
Project: Study on fatigue crack initiation from hole/s
Metallurgical and Materials Engineering *GPA: 9.2/10*

GATE coaching facility **Trivandrum, India**
Worked as a faculty member teaching undergraduate students August 2014 – April 2015

Mar Baselios College of Engineering and Technology **Kerala, India**
Bachelor of Technology July 2010 – June 2014
Project: CFD analysis of flame in a burner
Mechanical Engineering *GPA: 7.84/10*

Awards:

- Best poster award for poster presentation on "Effect of HPT Processing on Fracture Behavior of Maraging Steels" at the **International Conference on Fracture (ICF)**, Atlanta, Georgia, June 11-16, 2023.
- Best poster award for poster presentation on "Failure behavior of nanostructured Maraging steels" at the **19th ICSMA-2022**, Metz, France, June 26-July 1, 2022.
- Best oral presentation for presentation on "Effect of HPT processing on deformation behavior of Maraging Steel 250" at the 75th Annual Technical Meeting of the Indian Institute of Metals, NMD-ATM, IIT Bombay, Mumbai, 13-15th November 2021.
- Best Microstructure award (TEM and APT) category at the **75th Annual Technical Meeting of the Indian Institute of Metals**, NMD-ATM, IIT Bombay, Mumbai, 13-15th November, 2021.
- Best Oral Presenter for presentation on "Modeling the strengthening and softening mechanisms in Maraging steel 250" at the **Structural Integrity and Conference Exhibition (SICE)-2020**, IIT Bombay, Dec 14-16, 2020.
- Best Oral Presenter for presentation on "Effect of HPT processing on Maraging Steels" at MEMS department symposium, IIT Bombay, Mumbai, Maharashtra, 2019.
- Silver medalist from NIT Rourkela, Odisha, Department topper 2017.

Proposals and Grants:

- **DE-FOA** proposal on " Scalable Manufacturing and Irradiation Qualification of GARS-Processed 14YWT ODS Steels for Fusion First-wall Structural Material" for FY 2026 (Narrative writing and technical idea formulation)
- **DOE Genesis** proposal on "Gas Atomization Reaction Synthesis (GARS) of ODS Steels: AI-Driven Process–Structure–Property Design for Fusion Structural Materials" for FY 2026 (Narrative writing)
- Formulated the in-situ deformation designs and techniques necessary for testing small-scale irradiated micro tensile samples necessary for the **CHADWICK** grant in 2024.
- Integral part of writing **NEET-DOE** grant that funded the ODS steel production through GARS-based technique for tubing and ducts in the reactor.
- **APS user proposal 2024** cycle, received user time for analyzing Pseudomorphic phase transformation behavior in Mg-Nb nanolaminates.
- Part of the **CINT 2023** user proposal writing for "Understanding the Interface Strain Induced hcp-to-bcc Phase Transformation in Nanolaminate Mg", which received funding.

Selected Technical Presentations and Conferences:

- Oral presentation on "A Novel Processing Approach for Radiation-Tolerant 14YWT Steel for Nuclear Fission Power Reactor Applications" at **TMS 2026**, San Diego, California, March 15-19, 2026
- Oral presentation on "Orientation and Temperature Dependence of Deformation Mechanisms in Tantalum: Insights From Micropillar Compression Tests" at **TMS 2026**, San Diego, California, March 15-19, 2026
- Oral presentation on " Effect of processing on the nanomechanical properties of 14YWT ODS steels" at **TMS 2025**, Las Vegas, Nevada, March 23-27, 2025.
- Oral presentation on " Understanding the Pseudomorphic Hcp to Bcc Phase Transformation in Nanolaminate Mg" at, **TMS 2024**, Orlando, Florida, March 3-7, 2024.
- Oral presentation on " Understanding the Pseudomorphic Hcp to Bcc Phase Transformation in Nanolaminate Mg" at **MS&T23**, Columbus, Ohio, October 1-4, 2023.
- Poster Presentations on "Grain Interface Functional Design to Create Damage Resistant Polycrystalline Metallic Materials" at the **CANFSA** spring meeting, Golden, Colorado, March 29-31, 2023.
- Poster presentation on "Understanding the Interface Strain Induced hcp-to-bcc Phase Transformation in Nanolaminate Mg" at 2023 **Physical Metallurgy Conference GRC**, July 9-14, 2023.
- Oral Presentations on "Effect of HPT Processing on Fracture Behaviour Of Maraging Steels" at the **International Conference on Fracture (ICF)**, Atlanta, Georgia, June 11-16, 2023.
- Oral Presentations on "Fracture behaviour of HPT processed Maraging steel 250" at the **19th ICSMA-2022**, Metz, France, June 26-July 1, 2022.
- Poster Presentations on "Failure behavior of nanostructured Maraging steels" at the **19th ICSMA-2022**, Metz, France, June 26-July 1, 2022.
- Oral Presentations on "High Pressure Torsion Processed Maraging steels: Microstructure and Mechanical Behavior" at the **TMS-2021** Virtual.
- Oral Presentations on "Modelling the strengthening and softening mechanisms in Maraging steel 250" at the **Structural Integrity and Conference Exhibition (SICE)-2020**, IIT Bombay, Dec 14-16, 2020.
- Poster Presentations on "Precipitation Kinetics of HPT Processed Maraging Steels" at **ISMANAM-2019**, IIT Madras, July 8-12, 2019
- Oral Presentations on "Precipitation Kinetics of HPT Processed Maraging Steels" at the **Microstructural Engineering 2018-19**, IIT Kanpur, March 30-31, 2019.

Leadership Experience:

- Mentored 7 graduate and several undergraduate students during the doctoral and postdoctoral research period.
- Trained multiple students on instruments such as SEM, TEM, Nanoindenters and UTM.
- Assisted professors in conducting courses and lab subjects at IIT Bombay, including mechanical deformation and basic characterization courses.
- Course instructor for Technical Education Quality Improvement Program (TEQIP): (Online Course) Data and error analysis using R programming.
- Organized the Material Science department symposium at IIT Bombay between 2018-2021.
- Tutored B.Tech students to help them successfully complete the arrears they had over their coursework.
- Sports coordinator at IIT Bombay between 2019-2022.

References:

1. Prof. Nagamani Jaya Balila
Associate Professor, Metallurgical Engineering and Materials Science, Indian Institute of Technology Bombay
Email: jayabalila@iitb.ac.in

2. Dr. Nicolas Argibay
Ames Laboratory Scientist IV, Ames National Laboratory, Iowa, USA
Email: nargibay@ameslab.gov

3. Dr. Iver E Anderson
Professor Emeritus, Materials Science and Engineering, Iowa State University/Ames Laboratory, Iowa, USA
Email:andersoi@ameslab.gov

4. Dr. Sid Pathak
Assistant Professor, Materials Science and Engineering, Iowa State University
Email: pathak@iastate.edu

Technical Skills:

Selected instruments with hands-on experience:

Universal Testing machine

- 8 years of experience on Instron and MTS 200 kN and 5 kN equipped with optical DIC for full-field strain mapping

Nanomechanical testing:

- 3 years of experience using Alemnis *In-situ* nanomechanical testers
- XP, Triboindenter TI950, iMicro indenter

Transmission electron microscope

- 7 years of experience using Tecnai G2 F30
- 4 years of experience using FEI Titan Themis 300

Scanning electron microscope

- 5 years of experience on FEI Helios Focus Ion Beam (dual beam) system
- 6 years of experience on FEI Teneo field emission scanning electron microscope (imaging, EBSD/EDS)
- 2 years of experience on FEI Helios PFIB G4

XRD - PANalytical EMPYREAN

Softwares:

Alemnis Nanoindenter – *In-situ* nanomechanical software
APT data analysis – CAMECA IVAS
FEA simulations – ABAQUS, mechanical deformation module
SolidWorks – Design and rendering software
MATLAB – Data analysis and plotting software
Origin – Data plotting and analysis software