Dr. Saptarshi Dutta

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RESEARCH INTERESTS

- Mechanical behaviour of metals
- Creep studies on metals
- Fatigue
- Structure-property correlation
- Friction stir processing of alloys
- Various characterization of techniques through mechanical and metallurgical analysis (Tensile, Hardness, DSC, TGA, FESEM, EBSD, XRD, TEM).
- Machine Learning
- Evolutionary Algorithms

EDUCATIONAL QUALIFICATION

Qualification	Board/Institute/University	Year of Passing	Class/Remark
Ph.D. (Mechanical)	Indian Institute of Technology Guwahati, India	2023	Degree awarded
M-Tech (Mechanical)	National Institute of Technology Silchar, India	2011	First class
B.Tech (Mechanical)	Sathyabama University, India	2009	First class

Ph.D. RESEARCH TOPIC

- **Title**: Experimental investigation and creep correlation of Zr-2.5Nb alloy

   Supervisor : Prof. P.S. Robi   (*Thesis defended on 3rd November 2023*)

Pressure tubes (PT) are a key component of Pressurized Heavy Water Reactors used in Nuclear Power Plants. It provides structural integrity as well as contain the fuel bundles. Zr-2.5Nb alloys are the material of choice for manufacturing PTs. During a postulated design accident, the PTs are subjected to harsh environments and there may be significant dimensional changes in the tubes due to creep in the longitudinal and circumferential directions. A thorough understanding and prediction of the creep life of PTs along both the directions becomes imperative for the proper functioning of reactors.

In this work, high temperature tensile tests and a number of creep experiments were done on samples taken from both the longitudinal and transverse directions of the PTs. All the creep tests were done on a creep setup which was conceptualized and designed in-house. TEM studies on sample tensile tested at 800°C showed a network of Nb-enriched β-Zr phase around the α- phase, leading to grain boundary sliding. Zr-2.5Nb alloy exhibited Superplasticity at elevated temperatures. Analysis of minimum creep rate, strain to rupture, and rupture time by Monkman-Grant relation and modified Monkman-Grant relation indicated that both methods were valid for the alloy. In a first, ANN was used to predict the creep curves of the alloy. With the developed model, 98 % of the creep strains could be successfully predicted within a deviation error of ± 5%. Larson-Miller (LM) parametric technique was used to predict the creep life. It was observed that C_{L-M} value in the LM technique was not a constant but rather dependant on stress. The creep life predicted using the modified C_{L-M} value was more conservative when compared to that predicted using C_{L-M} as a constant.

REFERRED JOURNAL PAPERS

1. **S. Dutta,** P.S. Robi, **"**Experimental investigation and correlation of elevated temperature mechanical behaviour of Zr-2.5Nb alloy**.", *Journal of Materials Science*,** 57, 22157–22172 (2022). https://doi.org/10.1007/s10853-022-08031-9. **(**IF 4.5).

2. **S. Dutta,** P.S. Robi, "Experimental investigation and modeling of creep curve of Zr-2.5Nb alloy by machine learning techniques.", ***Metals and Materials International,*** (2022). https://doi.org/10.1007/s12540-022-01182-z (IF 3.5).

3. **S. Dutta,** P.S. Robi, "Analysis of tensile flow and work hardening behavior of Zr-2.5Nb alloy in the framework of Kocks — Mecking approach.", ***Journal of Mechanical Science and Technology***, 35, 3369–3374 (2021). https://doi.org/10.1007/s12206-021-0710-1 (IF 1.6)

4. D. Datta, **S. Dutta**, A binary-real-coded differential evolution for unit commitment problem, ***International Journal of Electrical Power & Energy Systems***, 42 (2012) 517–524 (2012). https://doi.org/10.1016/j.ijepes.2012.04.048. (IF 5.2)

5. **S. Dutta,** P.S. Robi, "Analysis of Monkman-Grant relationships and damage tolerance factor for creep of Zr-2.5Nb alloy.", (*To be communicated*)

6. **S. Dutta,** P.S. Robi**,** "Application of Modified Larson–Miller Parameter Technique for Predicting Creep Life of Zr-2.5Nb alloy." (*To be communicated*)

BOOK CHAPTER

1. **S. Dutta ,** P.S. Robi, "Development in Materials for Sustainable Manufacturing.", **Sustainable Material Forming and Joining,** 77-89, 2019.

CONFERENCES

1. **S. Dutta** , P.S. Robi, P. Majumdar, "High Temperature Tensile Behavior of Zr-2.5 wt % Nb Alloy Pressure Tubes", 4th International Conference on the Science and Engineering of Materials(ICoSEM2019), 26 - 28 August 2019, Malaysia.

2. **S. Dutta** , P.S. Robi, "Tensile behaviour and microstructural evolution of Zr-2.5%Nb alloy with temperature", 8th Asian Conference on Mechanics of Functional Materials and Structures,(8th ACMFMS-2022), 11th-14th December 2022, IIT Guwahati, Guwahati, India.

3. **S. Dutta** , D.Datta, " A binary-real-coded differential evolution for unit commitment problem: a preliminary study", Multi-disciplinary Trends in Artificial Intelligence: 5th International Workshop, MIWAI 2011, Hyderabad, India, December 7-9, 2011.

LABORATORY TESTING SKILLS (HANDS ON EXPERIENCE)

- Metallographic sample preparation (polishing, etching and electro polishing)
- Twin jet polishing, punching, colloidal doping and thinning
- Tensile testing (From room temperature to 1073K)
- Fatigue testing (Room temperature)
- SEM (ZEISS Gemini), EBSD, EDS, high quality analysis
- 250kN Servohydraulic Universal Testing Machine
- X-Ray Diffraction (Rigaku)
- Friction Stir Welding
- PIN on Disc
- Differential Scanning Calorimetry, Thermo Gravimetric System
- Wire EDM, Precision Saw, Ball Milling, Muffle furnace

SOFTWARE SKILLS

- MATLAB
- Python
- AUTOCAD
- SOLIDWorks
- Origin
- Image J (Image analysis software)
- X-Pert high score (XRD analysis)
- Gatan software (TEM)

PROFESSIONAL EXPERIENCE

- **IIT Guwahati-Technology Innovation and Development Foundation** *Aug, 2023- continuing*

  Position: Post-Doctoral Researcher

  Job Role: I am involved in the application of Fuel cells as a source of power for Underwater operated

vehicles.

- **The Assam Royal Global University, India** *Sept, 2011- June, 2015*

  Position: Assistant Professor (Mechanical Engineering)

  Job Role: I was responsible for taking undergraduate classes, supervision of final year undergraduate projects and assisted in administrative tasks to maintain smooth daily operations.

FELLOWSHIPS/ACHIEVEMENTS

- My Doctoral studies in Indian Institute of Technology Guwahati was funded by **Ministry of Human Resource Development Scholarship (Government of India).**

- My Masters in National Institute of Technology Silchar was funded by **Ministry of Human Resource Development Scholarship (Government of India).**

- Received **Travel grant** to attend 4th International Conference on the Science and Engineering of Materials(ICoSEM2019),2022 Malaysia from Dept. of Mechanical Engg., IIT Guwahati.

- **Chaired** an international conference session in the 8th Asian Conference on Mechanics of Functional Materials and Structures,(8th ACMFMS-2022) conducted from 11th-14th December 2022 at IIT Guwahati, Guwahati, India.

DETAILS OF REFEREES

Dr.P.S. Robi
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Dr. R. Ganesh Narayanan
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JOURNAL REVIEWER

Reviewer of Journals from the following Publishing group

- American Society of Mechanical Engineering
- Elsevier
- Springer
- Sage Publications