Dr. Durga Pechetti

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Research Interests

Design of experimental facilities, failure mechanisms, surface engineering, multiphase flows, thermal spray, laser cladding, high-entropy alloys, design of experiments, cavitation, and erosion

Education

- **Indian Institute of Technology Madras (IIT Madras)** — Chennai, India
  MS + PhD, Interdisciplinary (Mechanical Engg. & Metallurgical & Materials Engg.) — *Jan 2019 - Jul 2026*
  - **Guides**: Prof. Dhiman Chatterjee (Mech. Engg.) & Prof. M Kamaraj (Met. & Mat. Engg.)
  - **CGPA**: 8.56 / 10
  - **Thesis**: Characterisation of Cermet and High-entropy Alloy Coatings using Novel Cavitation-Silt Erosion Test Facility
  - **Thesis Overview**: Hydro-turbines wear out through cavitation and silt erosion acting together. I built a novel combined wear test facility to reproduce this (patent pending: 202341063586). I then used it to evaluate advanced protective coatings, including cermets, polymers and high-entropy alloys, under simulated operating conditions.
- **Indian Institute of Technology Bhubaneswar (IIT Bhubaneswar)** — Bhubaneswar, India
  B.Tech (Honours), Mechanical Sciences — *2011 - 2015*
  - **CGPA**: 8.03 / 10
  - **B.Tech Project**: Studied heat transfer augmentation in serpentine and raccoon microchannels. Analysed the effect of pulsatile inlet flow rates using COMSOL simulations.

Research Experience

- **Indian Institute of Science** — Bengaluru, India
  Research Associate — *Sept 2026 - Present*
  - **Research Focus**: Involves studying thermo-mechanical behaviour of refractories using 3D DIC (Digital image correlation) and thermal imaging (using IR camera) as part of TRL-Krosaki project.
    Supervisors: Prof. Vikram Jayaram and Prof. Praveen Kumar
- **Indian Institute of Technology Madras** — Chennai, India
  Research Scholar — *Jan 2019 - Jul 2026*
  - **Test Facility Development**: Designed, fabricated, commissioned and characterised a novel accelerated wear test facility. It reproduces combined cavitation jet erosion and slurry erosion for hydro-turbine materials.
  - **Coating Process Optimisation**: Developed and optimised deposition processes for protective coatings. Cermets by HVOF and HVAF, polymers by cold spray, and high-entropy alloys by laser cladding.
  - **Wear Testing & Characterisation**: Ran wear tests and materials characterisation using SEM, EDX, XRD, profilometry and hardness testing. Linked microstructure and properties to coating performance under synergistic erosion.
  - **IP & Dissemination**: Co-authored the patent application for the test facility (App. No. 202341063586). Published in peer-reviewed journals and conference proceedings.
  - **Project Management & Funding**: Contributed to securing research funding from CPRI and SJVN. Wrote proposals and reports, and managed project deliverables.
- **Indian Institute of Technology Madras** — Chennai, India
  Research Scientist — *Jun 2025 - Feb 2026*
  - **Research Focus**: Assessed in-service field tests on the failure of guide vane sealing rings in a Francis turbine. Part of the SJVN consultancy project on alternatives to WC in hard coatings for silt and cavitation erosion resistance.
- **Tohoku University, Fracture and Reliability Research Institute** — Sendai, Japan
  Visiting Research Scholar — *Jan 2024 - Mar 2024*
  - **Research Focus**: Studied powder and substrate surface preparation for depositing a polyurethane and nano-ceramic composite coating by low-pressure cold spray. Supervisor: Prof. Kazuhiro Ogawa. Supported by the IITM Global Engagement Travel Award.

- **Indian Institute of Technology Madras** Chennai, India
  Project Associate *Jan 2018 - Dec 2018*
  – **Project Initiation Support**: Contributed to the initial setup of the erosive wear test facility project funded by the Central Power Research Institute (CPRI). Supervisors: Prof. D. Chatterjee and Prof. M Kamaraj.
- **University of Twente** Enschede, Netherlands
  Research Intern *May 2014 - Jul 2014*
  – **Image Processing for Flow Analysis**: Wrote MATLAB image processing code to analyse high-speed imaging data of particles in turbulent flows. Determined displacement, velocity and acceleration. Supervisor: Prof. Detlef Lohse.
- **Indian Institute of Technology Madras** Chennai, India
  Research Intern *May 2013 - Jul 2013*
  – **Two-Phase Flow Simulation**: Carried out analytical modelling and COMSOL phase field simulations for water-oil flow. Established the relation between interface height and flow rate. Supervisor: Prof. Ashis Kumar Sen.

Publications

Peer-reviewed

1. D Pechetti, D Chatterjee & M Kamaraj (2025). Development and Characterisation of a Novel Accelerated Combined Cavitation and Silt Erosion Test Facility. *Wear*, 578-579, 206139. doi:10.1016/j.wear.2025.206139
2. D Pechetti, D Chatterjee & M Kamaraj (2024). Assessment of synergistic cavitation and silt erosion performance of hydraulic turbine steel. *IOP Conf. Ser.: Earth Environ. Sci.*, 1411(1), 012072. doi:10.1088/1755-1315/1411/1/012072

Under review

3. D Pechetti, M Navaselviya, D Chatterjee, M Kamaraj, SR Bakshi & AK Sharma (2026). A comparative study of WC-CoCr and CrC-NiCr coatings deposited by HVOF and HVAF for mitigating combined cavitation and silt erosion in hydraulic machinery. *Wear* (submitted). Preprint: ssrn.6512239

In preparation

4. D Pechetti, M Navaselviya, D Chatterjee, M Kamaraj, KCH Kumar, SM Shariff & S Ganesh. Role of Nb and laser cladding parameters on the structure and cavitation-silt erosion performance of AlCoCrFeNi high-entropy alloys. (Manuscript ready)
5. D Pechetti, D Chatterjee & M Kamaraj. Cavitation and Silt Erosion Behaviour of HVOF and HVAF Sprayed WC-CoCr and CrC-NiCr Coatings. (Manuscript in preparation)

Patents

1. Chatterjee, D., Kamaraj, M. & **Pechetti, D.** (2023). *A system for accelerated synergistic wear test of cavitation and silt erosion of ductile materials and method thereof.* Indian Patent Application No. 202341063586. Filed 18 Sep 2023. Pending.

Conference Presentations

1. **Pechetti, D.** (2024). Low Pressure Cold Spray of Erosion Resistant Polymers. *Poster presentation for IIE awardees by Global Engagement, IIT Madras*, Chennai, India. Poster, 9 Oct 2024.
2. **Pechetti, D.**, Chatterjee, D. & Kamaraj, M. (2024). Assessment of synergistic cavitation and silt erosion performance of hydraulic turbine steel. *32nd IAHR Symposium on Hydraulic Machinery and Systems*, Roorkee, India. Oral, Sep 2024.
3. **Pechetti, D.**, Chatterjee, D. & Kamaraj, M. (2024). Numerical investigation of the effect of orifice surface roughness on cavitation. *12th International Symposium on Cavitation (CAV2024)*, Chania, Greece. Oral, 2-5 Jun 2024.

Awards and Research Funding

- **NSFMFP Best Ph.D. Thesis Lecture Award 2026**: National Society for Fluid Mechanics and Fluid Power. Award lecture at FMFP 2026, NIT Rourkela, 10-12 Dec 2026.
- **Research Funding Secured**: Contributed to proposals that secured CPRI and SJVN funding for coating evaluation, 2022 to 2025, covering high-entropy alloy coatings and alternatives to WC in hard coatings for hydro-turbine components.
- **Projects Delivered**: Key contributor to the two projects above, to the earlier CPRI project establishing the erosive wear test facility, and to the SJVN field test evaluation.
- **IITM Global Engagement Travel Award**: Funding for a Visiting Research Scholar position at Tohoku University, Japan, 2023.

Teaching Experience

- **Indian Institute of Technology Madras** Chennai, India
  Teaching Assistant *2020 - 2023*
  - **Courses**: Engineering Drawing, Basic Thermal Engineering, Thermodynamics, Principles of Turbomachinery, and Measurements in Thermal Engineering (theory and lab).
  - **Responsibilities**: Ran tutorials and lab classes for B.Tech, MS, M.Tech and PhD students. Assisted with grading and course management.

Technical Skills

- **Wear Testing & Flow Systems:** Design and operation of a combined cavitation and silt erosion test rig, ASTM G32 cavitation testing, slurry erosion testing, high-speed imaging, laser flow visualisation, laser Doppler velocimetry (LDV), pump systems (positive displacement, centrifugal, monoblock), valves, sensors (pressure, temperature, dynamic pressure), DAQ systems, flowmeters (electromagnetic, ultrasonic), hydrocyclone.
- **Materials Deposition & Processing:** Cold spray operation, laser texturing, ball milling, ultrasonic mixing, magnetic stirring.
- **Materials Characterisation:** SEM, EDX, XRD and analysis (X'Pert HighScore), surface profilometry (contact and optical), Vickers hardness testing, goniometry (contact angle).
- **Software & Simulation:** SolidWorks, ANSYS (Workbench, Fluent), ICEM CFD, COMSOL Multiphysics, Thermo-Calc, MATLAB, Origin, ImageJ.
- **Programming & General:** C++, ITcl-Tk, XML, technical writing, grant proposals, manuscript preparation.

Work Experience (Prior to PhD)

- **Altair Engineering** Bengaluru, India
  Software Engineer *Jun 2015 - Dec 2017*
  - **Software Development**: Developed and maintained mechanical engineering software (HyperMesh, HyperWorks Unity) using C++, ITcl-Tk and XML within an Agile team.

Professional Service & Leadership

- **Student Coordinator, Organising Committee**: International Cold Spray Conference (ICSC 2026), 23-25 January 2026, IIT Madras Research Park. Conference logistics and participant coordination.
- **Student Coordinator, Organising Committee**: Asian Thermal Spray Conference (ATSC 2023), 2-4 November 2023, IIT Madras. Technical session and on-site coordination.
- **Head, Publicity Team**: Alma Fiesta 2014, socio-cultural festival, IIT Bhubaneswar.

Professional Development

- Five-day workshop on Technical and Scientific Writing, IIT Madras, 23-27 Nov 2024.
- NPTEL+ online workshop on Dispersed Multi Phase Flow Fundamentals, Prof. S Balachandar, 4-6 Oct 2024.
- NPTEL+ online workshop on Optical Measurement Techniques in Fluid Mechanics, Prof. C. Tropea, Nov 2023.
- Short course on Measurement Techniques for Interfacial Phenomena, Prof. C. Tropea, IIT Madras, Mar 2023.
- Workshop on Thermal Spray Technology & Applications, IITM & IIM Chennai Chapter, Oct 2022.
- Online course on Fatigue and Fracture Behaviour of Materials, Components and Structures, CSIR-SERC, Aug 2021.
- One-week online course on Design of Experiments 01 Basics, Ekaagra Solutions, 11-15 Jan 2021.
- Two-day workshop on X-ray Applications in Industry, IIM / ASM Chennai & IIT Madras, 14-15 Jun 2019.