EDITORIAL

Towards Enduring Materials and Sustainable Engineering: The Launch of *JMDE*

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In the rapidly evolving landscape of science and engineering, materials remain the backbone of technological progress. They define the strength of our bridges, the reliability of our aircraft, the performance of our electronics, and the sustainability of our infrastructure. As innovation accelerates and societal demands evolve, a central question looms larger than ever: how can we ensure that materials are not only high-performing, but also durable, reliable, and fit for long-term service? It is in response to this fundamental question that we launch the *Journal of Materials Durability and Engineering* (*JMDE*). This journal aspires to serve as a multidisciplinary and forward-looking platform for disseminating original research, reviews, and application-oriented studies that advance our understanding of materials and structures under conditions that challenge their integrity.

1 The Relevance of Durability in a Changing World

The demands on materials today are unlike any in history. They are expected to perform in extreme temperatures, corrosive environments, and under complex stress states–often for decades without failure. Fatigue, corrosion, fracture, and environmental degradation are no longer peripheral concerns; they are central to design, operation, and maintenance in virtually every sector of engineering, from aerospace and marine to energy and biomedical systems.Moreover, these material challenges are now intertwined with broader concerns about sustainability, resource efficiency, and the life-cycle impact of engineering systems. Enhancing durability is not simply a technical issue–it is increasingly a societal one. Durable materials mean fewer replacements, lower maintenance costs, less downtime, and most importantly, reduced environmental footprint. In an era of circular economy and climate accountability, material longevity is sustainability.Despite decades of progress in metallurgy, surface science, mechanics, and processing technologies, many durability-related phenomena remain poorly understood, especially when materials are subjected to coupled effects–corrosion-fatigue, high-temperature creep-fracture, or hydrogen embrittlement, to name just a few. *JMDE* is launched with the mission of tackling these coupled challenges through rigorous science and innovative engineering.

2 The Journal's Scientific Scope

JMDE's scope is intentionally broad yet thematically focused on durability [1, 2], degradation, protection, and performance of materials and structures. It welcomes studies across all classes of materials–metals,

Submitted: 17 June 2025
Accepted: 17 June 2025
Published: 29 June 2025

Vol. 1, **No.** 1, 2025.
10.62762/JMDE.2025.961397

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Citation
Zhang, P. (2025). Towards Enduring Materials and Sustainable Engineering: The Launch of JMDE. *Journal of Materials Durability and Engineering*, 1(1), 1–3.

ceramics, polymers, composites, coatings, hybrids–and at all relevant scales, from atomic to structural.

Areas of particular interest include:

- Fatigue, creep, and fracture behavior under realistic service conditions;
- Corrosion mechanisms, electrochemical degradation, and interface stability;
- Protective coatings and surface engineering for environmental resistance;
- Influence of manufacturing methods (e.g., machining, additive manufacturing, heat treatment) on microstructure and service performance;
- Microstructural evolution and phase transformation under multiaxial loading;
- Advanced characterization of degradation phenomena using EBSD, TEM, XRD, in-situ and 3D methods;
- Modeling and simulation of failure processes using finite element, crystal plasticity, molecular dynamics, and AI-based tools;
- Lifecycle prediction, service reliability, and structural integrity assessment.

Beyond these, *JMDE* is open to interdisciplinary studies involving material design, sustainability, digital twin technology, and bio-inspired durability strategies, as long as the core contribution advances understanding of how materials endure–or fail–under demanding conditions.

3 Rethinking Durability as a Design Principle

Historically, material selection and design often focused on initial mechanical properties: strength, stiffness, ductility. However, a material that performs well in a lab may behave very differently after five years of cyclic loading in seawater, or after repeated thermal cycling in a turbine environment. Durability must therefore be redefined as an integrated design consideration, not an afterthought.

To design for durability means to anticipate degradation–to understand not only the material's starting condition, but its trajectory through time, environment, and use. It means understanding crack nucleation thresholds, corrosion kinetics, creep resistance, and defect evolution. It also means designing interfaces, boundaries, and surfaces–not just bulk properties. It calls for synergy between metallurgy, mechanics, chemistry, and computational modeling.

At the same time, modern tools are enabling unprecedented access to the inner life of materials. In-situ TEM can now capture dislocation motion during fatigue [3, 4]; atom probe tomography can reveal the elemental evolution of corrosion pits; digital image correlation and 4D tomography allow for real-time deformation mapping. These tools, combined with machine learning and high-throughput simulations, are shifting our understanding from descriptive to predictive–a transformation that JMDE seeks to amplify.

4 Bridging Theory and Practice

JMDE aims to bridge the gap between theoretical insights and practical engineering solutions. It encourages both fundamental studies of damage mechanisms and application-driven research involving component design, process optimization, and performance validation. Papers that integrate modeling with experimentation, or that propose new testing methodologies under simulated service conditions, are especially welcomed.The journal also emphasizes real-world relevance. We encourage submissions that address durability in critical sectors–such as renewable energy, hydrogen infrastructure, marine transportation, high-speed rail, and space exploration–where long-term material behavior is directly linked to mission success, safety, and cost.

5 Editorial Responsibility and Scholarly Integrity

As founding editors, we recognize that a journal is more than just a collection of articles. It is a scientific community. We are committed to maintaining the highest standards of editorial transparency [5, 6], peer review rigor, and scholarly ethics. We will work to foster a constructive review process that is both critical and collegial, and to support early-career researchers with visibility and opportunity.Our editorial vision is not static. We will adapt as the field evolves, proactively identifying emerging topics, organizing focused issues, and supporting international collaboration. We will strive to represent global perspectives, recognizing that materials problems–and solutions–are not bounded by geography.

6 Looking Ahead

We are entering an exciting era in materials durability research. Novel alloy systems, nanostructured surfaces, self-healing coatings, and data-informed design paradigms offer transformative possibilities. But these innovations must be coupled with robust understanding of degradation mechanisms, accurate life-prediction models, and scalable engineering solutions.

At *JMDE*, we believe that the future of materials engineering lies not only in inventing the next strong or lightweight material, but in understanding how materials live, evolve, interact, and ultimately survive in the real world.

We invite you–researchers, engineers, designers, modelers, and experimentalists–to contribute your knowledge, creativity, and insight to this journal. Whether your focus is fatigue crack growth, stress corrosion cracking, process-induced microstructures, or system-level failure prediction, if your work helps the world build stronger, safer, longer-lasting materials and structures, then you belong here. Together, let us define the frontier of durable, sustainable, and intelligent materials engineering.

Welcome to the *Journal of Materials Durability and Engineering*.

Data Availability Statement

Not applicable.

Funding

This work was supported without any funding.

Conflicts of Interest

The author declares no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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Prof. Ping Zhang is a Professor of Materials Science and Engineering and the founding Editor-in-Chief of the *Journal of Materials Durability and Engineering*. He received his Ph.D. in Mechanical Engineering from Qingdao University of Technology, with postdoctoral training at East China University of Science and Technology, focusing on surface integrity and corrosion-fatigue interactions in marine-grade alloys.

Prof. Zhang's research lies at the intersection of advanced manufacturing, fatigue and fracture behavior, and corrosion protection technologies. His work has contributed significantly to the development of multi-energy field synergistic surface enhancement processes, including ultrasonic impact treatment and composite particle-assisted jet strengthening, particularly for titanium alloys used in aerospace and deep-sea applications.

He has published over 100 peer-reviewed articles in international journals, received several national awards including the National Defense Science and Technology Progress Award and the Ministry of Education Scientific Research Achievement Award, and has led multiple national and provincial-level research programs in China.

As Editor-in-Chief of *JMDE*, Prof. Zhang is dedicated to fostering interdisciplinary collaboration and advancing the global dialogue on materials durability, structural integrity, and sustainable engineering design. (Email: zpqdhhxy@126.com)