材料強度学 Mechanics of Materials

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2003年　早稲田大学理工学部機械工学科卒業
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構造材料や機能性材料の長期信頼性を確立することを目的として、ナノレベルからマクロスケールに至る材料強度特性や破壊現象を実験と解析により力学的な評価を行っている。具体的には以下のテーマに取り組んでいる。

1．金属材料の疲労損傷治癒技術の開発
電子風力による原子再配列・再結合を利用した疲労損傷治癒技術を提案している。疲労損傷治癒メカニズムを実験および解析的に明らかにし、構造材料の格段な長寿命化の実現を目指している。

2．繊維強化複合材料の超長疲労特性評価と寿命評価技術の構築
炭素繊維強化複合材料のギガサイクル疲労特性や損傷進展機構を実験及び解析的に評価している。繊維強化複合材料の寿命予測技術を高度化し、構造物の長期信頼性評価を確保することを目指している。

3．金属表面のナノ空間構造体の創製と異種材料直接接着技術への展開
金属表面に3Dナノ空間構造を創製し、アンカー効果と化学結合により炭素繊維強化複合材料との新しい異種接合技術を提案している。ナノ構造と化学結合による接合強度発現機構を明らかにし、ボルトレス構造への展開を目指している。

4．機能性ナノマテリアルの創成とその応用
ナノ材料は体積に対する表面積の割合が高く、これに起因して様々な機能性を発現できる可能性を秘めている。応力誘導法や陽極酸化・エッチングプロセスなどにより高密度・高秩序なナノ材料を創製し、格段に優れた機能性を有する材料の創製を目指している。

Pursuing long-term reliability of structural materials and functional materials, conducting mechanical evaluations of the strength characteristics and fracture phenomena of materials, from nano- to macro-scale, through experiments and analysis. More specifically, work in the following areas.

1. Development of a fatigue damage healing technique for metal materials
Propose a technique for healing fatigue damage using atomic rearrangement and recombination by electron wind force. Aim to clarify the fatigue damage healing mechanism through experiments and analysis, and achieve a remarkable prolongation of the product life of structural materials.

2. Establishment of techniques for evaluation of very high-cycle fatigue characteristics and fatigue life
Evaluate the fatigue characteristics in the gigacycle region, and the damage growth mechanism in carbon fiber-reinforced composite materials, through experiments and analysis. Aim to improve the life prediction technique for fiber-reinforced composite materials, and ensure long-term reliability in the evaluation of structures.

3. Creation of nano-space structures on metal surfaces, and development of a direct bonding technique for different kinds of materials
Create a 3D nano-space structure on a metal surface, and propose a new bonding technique for different kinds of materials, using fiber-reinforced composite materials, the anchor effect, and chemical bonding. Aim to clarify the mechanism involved in bonding strength development using nanostructures and chemical bonding, and apply the technique to boltless structures.

4. Creation and application of functional nanomaterials
Nanomaterials have a high ratio of surface area to volume, and have a variety of potential functionalities based on this feature. Aim to create high-density and highly ordered nanomaterials by utilizing the stress induction method, anode oxidation, and etching processes; and to create materials with strikingly superior functionalities.

■代表論文および著書 /Representative publications

(1) Yuki Nishi, Atsushi Hosoi, Hiroyuki Kawada, Evaluation of matrix crack growth in interlaminar toughened quasi-isotropic carbon-fiber reinforced plastic laminates up to the very-high cycle regime by ultrasonic fatigue testing, Composites Science and Technology, 2024, 26, 110623.
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(5) Hiroki Ota, Kristine Munk Jespersen, Kei Saito, Keita Wada, Kazuki Okamoto, Atsushi Hosoi, Hiroyuki Kawada, Effect of the interfacial nanostructure on the interlaminar fracture toughness and damage mechanisms of directly bonded carbon fiber reinforced thermoplastics and aluminum, Composites Part A: Applied Science and Manufacturing, 2020, 139, 106101.
(6) Kristine Munk Jespersen, Hiroki Ota, Kazuki Harada, Atsushi Hosoi, Hiroyuki Kawada, Experimental measurement of mode-I fracture toughness of dissimilar material joints with thermal residual stresses, Engineering Fracture Mechanics, 2020, 385, 107249.
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(9) Atsushi Hosoi, Hiroyuki Kawada, Fatigue life prediction for transverse crack initiation of CFRP cross-ply and quasi-isotropic laminates, Materials, 2018, 11(7), 1182, (1-16pages).
(10) Kristine M. Jespersen, Jens A. Glud, Jens Zangenberg, Atsushi Hosoi, Hiroyuki Kawada, Lars P. Mikkelsen, Ex-situ X-ray computed tomography, tension clamp and in-situ transilluminated white light imaging data of non-crimp fabric based fibre composite under fatigue loading, Data in Brief, 2018, 21, 228-233.
(11) Kristine M. Jespersen, Jens A. Glud, Jens Zangenberg, Atsushi Hosoi, Hiroyuki Kawada, Lars P. Mikkelsen, Uncovering the fatigue damage initiation and progression in uni-directional non-crimp fabric reinforced polyester composite, Composites Part A: Applied Science and Manufacturing, 2018, 109, 481-497.
(12) Atsushi Hosoi, Yuhei Yamaguchi, Yang Ju, Yasumoto Sato, Tsunaji Kitayama, Detection and quantitative evaluation of defects in glass fiber reinforced plastic laminates by microwaves, Composite Structures, 2015, 128, 134-144.
(13) Atsushi Hosoi, Shigeyoshi Sakuma, Yuzo Fujita, Hiroyuki Kawada, Prediction of initiation of transverse cracks in cross-ply CFRP laminates under fatigue loading by fatigue properties of unidirectional CFRP in 90° direction, Composites Part A: Applied Science and Manufacturing, 2015, 68, 398-405.
(14) Atsushi Hosoi, Hisataka Koto, Yang Ju, Fabrication of AFM probe with CuO nanowire formed by stress-induced method, Microsystem Technologies, 2014, 20(12), 2221-2229.
(15) Atsushi Hosoi, Kishi Tomoya, Yang Ju, Healing of fatigue crack by high-density electropulsing in austenitic stainless steel treated with the surface-activated pre-coating, Materials, 2013, 6(9), 4213-4225.
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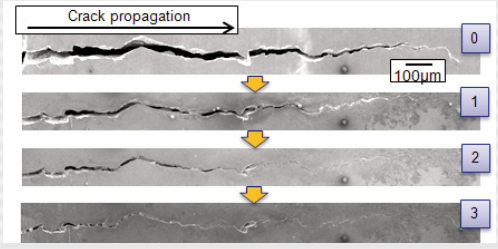

Fatigue crack healing