

Division of Electrical Engineering and Computer Science	Research field	Nanoscale Measurement Technologies	Lab. ID EC02
Laboratory web site	http://fukuma.w3.kanazawa-u.ac.jp/		
Research subjects			
We are working on instrumentation of atomic force microscopy (AFM) and its application to various academic and industrial studies. In AFM, a sharp probe is scanned over a surface to image atomic-scale or nanoscale surface structures and properties of materials. In 2005, Prof. Fukuma enabled to operate frequency modulation AFM (FM-AFM) in liquid with true atomic resolution for the first time in the world. Based on this achievement, we are working on the instrumentation and applications of the world-leading scanning probe microscopy techniques.			
Master/Doctor course: Education policy, curriculum, typical activity in the laboratory			
Through research activities, students are expected to learn interesting and exciting aspects of reseach as well as to acquire an ability to solve unexperienced problems by themselves. To this end, we provide opportunities to have discussions with your supervisor. All the students have a 5-10 min meeting with your supervisor every morning. We also have a weekly meeting for each subgroup consisting of 3-5 members. In addition, we have a monthly meeting, where all the students give a research progress report or a presentation on a research article.			
Daily life in the laboratory, etc.			
All the members are supposed to come to the lab. by 9:30AM but they can freely decide when they go home. This is for helping students to have a helthy life cycle and for facillitating communications among the members. Beside the research meetings described above, we have an individual monthly meeting to discuss personal issues (Professor). In our lab., there are many researchers and students from different fields and countries, which helps us to improve our global communication skills (D1). Each student will not only be provided with a desk and a high performance PC separated by partitions, but also have access to meeting rooms and a stylish lounge in the newly constructed building, where they can concentrate on their research activities (M2).			
Message or comments by the laboratory faculty staffs			
After obtaining a master's degree, one student per a 1-2 years goes to doctoral course. Majority of the students find a job in a company related to electrics or computer science, yet some students find a job in a chemistry or mechanics company. Nanoscale measurement technology is an interdisciplinary reseach area and hence related to almost all the academic fields including physics, engineering, chemistry and biology. Thus, the professional career of the students has a significant diveersity. In our lab., we collaborate with many industrial companies. Thus, some students find a job in one of these companies.			
Recent Master theses in these 3 years (+ more if appropriate)			
year.month	Thesis title (including English translation of Japanese thesis title)		
2021.3	Molecular-Scale Study on Solid-Liquid Interfacial Phenomena by Three-Dimensional Scanning Force Microscopy		
2021.3	Mass and elasticity changes of keratinocytes induced by moisturizer investigated by atomic force microscopy		
2021.3	Nanoscale In-situ Analysis of Corrosion Mechanisms at Alloy Surfaces by In-Liquid Potential Distribution Measurement Technique		
2020.9	Development of low noise and wideband high voltage amplifier for atomic force microscope		
2020.3	Atomic-Resolution Imaging of Crystal Dissolution Processes by High-Speed 3D-AFM with Low-Noise and High-Sensitivity Force Detection System		
2020.3	Electrochemical imaging of single crystals using scanning electrochemical cell microscopy		
2020.3	Corrosion Mechanisms of Metallic Materials and Devices Investigated by In-Liquid Nanoscale Potential Measurement Technique		
2020.3	Changes in Nanoscale Surface Structures of Lung Cancer Cells Associated with Acquisition of Drug Resistance Investigated by In-Liquid AFM		
2020.3	Visualization of the molecular interaction of single extracellular vesicles using scanning ion conductance microscopy		
2020.3	Molecular-Scale Analysis of Organic Liquid - Substrate Interfaces inside Field Effect Devices by 3D-AFM		
2019.3	Development of AFM with Environmental Control System and Its Applications to In-situ Measurements of Nanoscale Structures and Properties		
2019.3	Nanoscale In-situ Analysis of Corrosion at Alloy Surfaces by Open-Loop Electric Potential Microscopy in Liquid		
2019.3	Subnanometer-Scale Analysis of Three-Dimensional Fluctuating Structures by Liquid-Environment Atomic Force Microscopy		
2019.3	Development of high resolution scanning ion conductance microscopy		

2019.3	Development of scanning electrochemical cell microscopy for local operando measurement of battery materials
2018.3	Development of magnetic excitation system for AFM cantilever and its applications to atomic-resolution imaging of photocatalyst nanoparticles in liquid
2018.3	Nanoscale in-situ studies on metal corrosion by open-loop electric potential microscopy in liquid
2018.3	Atomic-resolution imaging of calcite dissolution and growth processes using high-speed FM-AFM in liquid
2018.3	High-speed atomic-resolution AFM imaging of dynamic behavior of nanoscale pit structure in calcite dissolution process
2018.3	Molecular-scale adsorption structures of industrial materials investigated by 3D-AFM
2018.3	Development of local potential measurement technique for liquid environment and its applications to nanoscale studies on photocatalytic reaction mechanism
Recent Doctoral theses in these 3 years (+ more if appropriate)	
year.month	Thesis title (including English translation of Japanese thesis title)
2021.3	Development of In-liquid Local Potential Distribution Measurement Technique Based on Atomic Force Microscopy and Its Applications to Nanoscale Studies on Reaction Distributions at Electrode-Electrolyte Interfaces
2018.9	Study on the Memory Effect of Long-Lived Excited Species in Dielectric Barrier Discharge in He with N ₂ Admixture
2018.9	Subnanometer-scale 3D hydration and fluctuating structures by frequency modulation atomic force microscopy
2017.3	Molecular-scale investigations on self-assembled monolayers with a control function of molecular adsorption by atomic force microscopy in liquid
2016.3	Nanoscale Investigation on Stainless Steel Corrosion by Open-loop Electric Potential Microscopy in Liquid
2016.3	Development of High-speed Liquid-environment Frequency Modulation Atomic Force Microscope and Its Applications to Atomic-level Investigation on Calcite Crystal Dissolution Processes
2015.3	Improvement of stability and speed in liquid-environment atomic force microscopy
Laboratory mail address	
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