Underwater Nanoworld

Underwater Atomic Force Microscope

◆ Research Goal
In marine environment including deep sea, there are various microorganisms and mineral particulates, which are deeply related to the ecosystems and material circulation in the ocean. Our goal is to develop in situ nanoscale sensing technologies for observing and analyzing the microscopic marine resources in deep sea, and reveal new findings of the nature of ocean.

◆ Research Subjects
We are developing an Underwater Atomic Force Microscope (UAFM) system, which is mountable on various underwater vehicles for in situ nanoscale imaging in deep sea. The system is composed of various key technologies for operating UAFM in deep sea as follows:
- Compact and Portable UAFM: Downsizing, Lightweight, Water and Pressure resistance
- Sampling mechanisms using microfluidic devices: In situ sample collection, filtration, sorting, and fixation mechanisms, Environmental control system
- Mount mechanisms for underwater vehicles: Vibration isolation, Remote and Automatic control

AFM image of microorganisms collected from deep water

Sample holder

Self-sensitive cantilever

Deep-sea sample

Sample collection and fixation mechanisms using membrane filter

UAFM system mounted on remotely operated vehicle (ROV)