

Nano Hand-Eye System for Simultaneous Imaging and Characterization of Nano Objects

Hiroyuki Fujita

(The University of Tokyo, Institute of Industrial Science, Professor)

【 Outline of survey 】

Molecules and atoms have sizes from 0.1 nm to a few tens of nm. In such a small scale, there appear peculiar phenomena, which are uncommon in our macroscopic world. The aim of nano technology is to utilize such phenomena in ultra-high-performance microelectronics and in medicine based on genetic diagnosis. The characterization of nano objects, such as an individual molecule, is extremely difficult because they are too small to be visualized by optical microscopes and to be handled by tweezers. In this research project, we will develop micromachined silicon tweezers to handle a molecule directly; the molecule will be visualized in special microscopes to facilitate handling capability and to characterize it in detail. We name the measurement apparatus as “ nano hand-eye system ”. Micromachined tweezers are less than 1 mm in length and have atomically sharp tips. In our previous work, the tweezers captured DNA molecules from water and applied force to pull or bend molecules; those processes were observed by fluorescent and electron microscopes. We will improve the system to widen the variety of objects and measurement capabilities (electrical measurement and/or mechanical measurement).

【 Expected results 】

The nano hand-eye system enables the multi-degree-of-freedom manipulation of nano objects and their multi-parameter characterization as well as visualization. Thus, it will contribute to the further development of nano and bio technologies. For example, DNA molecules carrying the genetic information are supposed to determine a person ' s susceptibility of a disease or of a side effect of a medicine. The understanding of such influence of genetic difference needs the knowledge of molecular interactions between DNA and other molecules as well as DNA sequences. The system developed in the project is capable of capturing a DNA molecule and visualize other molecules attached to it; this leads to the better understanding of the mechanism of living systems and to advance the future medicine.

【 References by the principal researcher 】

- (1) Hiroyuki Fujita (ed.) “ Micromachines as Tools for Nanotechnology ” Springer (2003)
- (2) Gen Hashiguchi, Takushi Goda ,Maho Hosogi, Ken Hirano , Noritada Kaji, Yoshinobu Baba , Kuniyuki Kakushima and Hiroyuki Fujita, “ DNA manipulation and retrieval from an aqueous solution with micromachined nanotweezers ”, *Annalytical Chemistry*, Vol.75,2003, pp.4347-4350

【 Term of project 】 FY 2004 - 2008

【 Budget allocation 】 87,700,000 yen

【 Homepage address 】

<http://www.fujita3.iis.u-tokyo.ac.jp>