Development of nano-spectroscopy using synchrotron radiation photoelectron emission microscope

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【Outline of survey】

We aim at developing a novel photoelectron emission microscope (PEEM) system with highly bright synchrotron radiation (SR) to reveal electronic properties of nanostructures in 1) magneto-electronics, 2) semiconductor electronics, 3) environmental science and 4) nano-biology. For development of next generation nanoelectronic devices, elucidation of chemical, electronic and magnetic structures in magnetic nanostructures, ultra-thin gate insulators and semiconductor quantum dots is strongly required. On the other hand, to reveal reaction mechanism on catalyst surfaces, chemical states, electronic state distribution and its temporal change should be analyzed in real ambient. Furthermore, electronic state and local structure of functional single molecules are strongly required to be directly analyzed.

So, we set the following four research targets:

1.Development of pump-probe time-resolved PEEM system under pulsed magnetic field with SR pulsed beam,

2.Observation of phase separation of ULSI gate insulator films with 50 nm spatial resolution and video-rate temporal resolution

3.Surface reaction analysis of catalysts in the 1 Pa ambient using differential pumping,

4.Nano-bio imaging by transparent X-ray absorption with bio-observation cell based on realtime spherical aberration correction method for spatial resolution of 10 nm.

【Expected results】

Novel nano-spectroscopy using synchrotron radiation photoelectron emission microscope with high spatial and temporal resolution would enable the elucidation of magnetic domain structures and magnetization mechanism in magneto-electronics, and phase separation structures and their mechanism of gate dielectrics in semiconductor electronics.

Reaction mechanism on catalyst surfaces in real ambient could be revealed to develop highly efficient catalysts. Furthermore, changes in electronic structure and local structure of functional single molecules could be directly analyzed to develop new functional bio-sensors.

【References by the principal researcher】

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【Term of project】 FY 2005 - 2009	【Budget allocation】 84,500,000 yen

【Homepage address】 http://www.chem.t.u-tokyo.ac.jp/appchem/labs/oshima/