Development of electron holography system for photoexcitation phenomena and its applications to materials science

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【Outline of survey】

The aim of this project is to develop a new electron holography system that reveals photoexcitation phenomena (e.g., change in the electric potential and/or carrier distribution) in materials. Especially, we will focus on the following points as the research subjects: (1) Development of a new specimen holder by which several types of light can be guided to a thin-foiled and/or powder specimens inside a transmission electron microscope; (2) Establishment of a shielding technique that protects a specimen from radiation damage by incident electrons; (3) Application of the devised methods to photoexcitation-related materials such as toner particles used in laser printing. Uniqueness of this study lies in the first holography experiment to image an electrostatic field that is induced by light exposure, and the use of a peculiar shielding technique to avoid serious radiation damage by electrons. Recently, electron holography attracts significant attentions from both academic and industrial fields because of its potential to materials characterization. This project will offer a new way of holography study that explores photoexcitation phenomena.

【Expected results】

The spatial resolution of electron holography has reached approximately 7 nm (or better) with a 300 kV transmission electron microscope. Once the holography technique is combined with the light exposure tool to establish a new system, it will be widely accepted in the research and development of nanomaterials. The issue of the toner particles is a typical example: the conventional technique was unable to reveal the change in the potential distribution by light exposure in the tiny particles, while the devised method will make a progress in this subject.

【References by the principal investigator】

・”Analytical Electron Microscopy for Materials Science”, (in Japanese)
D.Shindo and T.Oikawa, Kyouritsu, Tokyo (1999).
・”Analytical Electron Microscopy for Materials Science”, (in English)
D.Shindo and T.Oikawa, Springer-verlag, Tokyo (2002).

【Term of project】 FY2007－2011

【Budget allocation】 29,300,000 yen
(2007 direct cost)

【Homepage address】 http://www.tagen.tohoku.ac.jp/labo/shindo/index.html