Industrial Applications

Wide variation in the usage of atomic elements in mixed or composite materials has been a current trend in the industrial fields of semiconductors and metallic, magnetic, ceramic, and plastic materials. Many companies are now interested in the possibility of using synchrotron radiation X-rays for material characterization as well as development of new materials or improvement of production technologies. Measurement of XAFS, X-ray fluorescence analysis, and X-ray diffraction for small areas in such materials provides especially useful information in terms of crystallinity or component distribution. In this section, some interesting industrial applications of synchrotron radiation X-rays in the industrial field are shown.

Advanced rechargeable batteries are required for portable computers, phones, automobiles, and other various electronic products for communication. In order to improve the efficiency and prolong the life of these devices, it would be useful to explore the behavior of cathode materials in the batteries during the recharge cycle.

Development of high-density recording devices has been an active pursuit in the information technology field. Giant magnetic resistance multilayers can be one of the candidates for the high-density magnetic recording material. Therefore, detailed analysis is important to determine the precise components and multilayer thicknesses.

Feature sizes of electronic devices such as LSI's and semiconductor lasers have become progressively smaller. On the other hand, the diameter of substrate wafers is increasing, making homogeneity of crystal quality crucially important. In order to investigate minute strains giving rise to the generation of crystalline defects or wafer warpage, X-ray topography or micro-diffraction combined with a precisely parallel X-ray beam is advantageous. Large-diameter silicon wafers for future LSI's are imaged with a contrast depicting the strain distribution in topographic plates. Also peak shifts in the X-ray rocking curves using an X-ray microbeam show local lattice deformation in active regions in the electronic devices, which may lead to deterioration of the device performance or poor production yields.

Thus, the hard X-rays from third-generation synchrotron radiation such as those generated at SPring-8, are predicted to be useful for industrial material characterization.

Junji Matsui