Preface to Volume VII

This volume contains five review articles focusing various, but mutually related topics in nano electro-optics. The first article describes recent developments in the study of the temperature-induced phase transition and photo-induced phase transition of ferromagnetic RbMnFe complex. In addition, with non phase transition material of RbMnFe, the light-induced phase collapse is demonstrated, which may provide a good strategy for the next generation high density optical recording. As photo-induced phase transition at room temperature, large yield and fast response of the photo-conversion from the low- to high-temperature phase will allow us to consider a new type of optical switching device.

The second article is devoted to describing recent achievements relating to photo-induced energy transfer in artificial photosynthesis. In particular, the emphasis lies on self-assembled multi-porphyrin array that are highly promising materials for photo-catalysts, organic solar cells, and molecular optoelectronic devices. Well-defined molecule-based nanoarchitectures exhibiting energy transfer will open the door to nanoscience and nanotechnology, which stimulates a variety of fields including chemistry, biology, physics, and electronics to develop new scientific and technological principles and concepts.

The third article concerns the homoepitaxial growth and multiple-quantum wells (MQW) in ZnO. Fabrications on MQWs and their low-dimensional optical properties are discussed. Self-organized surface nanowires on M-nonpolar ZnO layers are also described, wherein discussions concentrate on a growth mechanism and developments concerning low-dimensional structures of quantum wires. Further, discussions of various properties of ZnCoO diluted magnetic semiconductors and fabrications of the quantum wells geometries are also given. Demonstrated homoepitaxial technique can be effective for electro-, magneto-, and optical applications based on ZnO.

The fourth article deals with two topics. The first topics is a novel polishing technique that uses near-field photochemical etching based on a nonadiabatic process, with which the roughness of an ultra-flat silica surface can be reduced to an Angstrom- level. Since this technique is a noncontact method without

a polishing pad, it can be applied not only to flat surfaces but also to three-dimensional surfaces. Furthermore, this method is also compatible with mass production. The second topics is the recent achievements with nanophotonics devices based on spherical quantum dots. Optical near-field energy transfer is described.

The last article describes polarization control in the optical near-field and far-field by designing the shape of metal nanostructure. Its application to multi-layer structures and optical security are also discussed. In particular the problem on rotating the plane of polarization is discussed, which should be solved for various applications; devices including nanostructures have already been employed, for instance, in so-called wire-grid polarizers.

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I hope that this volume will be a valuable resource for the readers and future specialists.

Tokyo, June 2009 *Motoichi Ohtsu*

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