The Photopolymer Science and Technology Award

The Photopolymer Science and Technology Award No. 01100 was presented to Hiroyuki Niino, Juergen Ihlemann, Shigeyuki Ono, and Akira Yabe (National Institute of Materials and Chemical Research (NIMC), Laser-Laboratorium Goettingen e.V., and Tsukuba Technical Laboratory, NOK Corporations) for their outstanding contribution published in the Journal of Photopolymer Science and Technology, **13**, 167-174 (2000), entitled "Surface Microstructure Formation by ns-, ps, and fs-Laser Ablation of an Elastomer Composite".

Hiroyuki Niino

Hiroyuki Niino received his B.S. degree from Kyushu University in 1986, and Ph.D. degree from Kyushu University in 1994 for the study on UV laser-induced surface modification of aromatic polymer films. He joined the National Chemical Laboratory for Industry, Tsukuba, in 1987. The institute has been reorganized to the National Institute of Advanced Industrial Science and Technology, Tsukuba in April 2001, and currently he is a senior researcher of Photoreaction Control Research Center at the institute. His research interests include the laser ablation and surface modification of materials with UV lasers.

Juergen Ihlemann

Juergen Ihlemann received his Ph.D. degree from University of Goettingen in 1987. In 1989 he joined Laser-Laboratorium Goettingen, Germany, where he is now the head of the laser ablation and micromachining group. His research interests include UV-laser structuring of surfaces and thin layers and femtosecond UV-laser ablation.

Shigeyuki Ono

Shigeyuki Ono received his M.S. degree in 1988 and Ph.D. degree (in Polymer Chemistry) in 2000 from Science University of Tokyo. He joined NOK Corporations in 1988 as a research chemist mainly engaged in the design of the composition of rubber materials and the sealing systems for packing and seals. He is a member of the Society of Polymer Science, the Society of Rheology, Japan and the Japan Society of Mechanical Engineers.

Akira Yabe

Akira Yabe received his B.S. degree from Yokohama City University in 1966, and Ph.D. degree from Tokyo Metropolitan University in 1981 for the study on photolysis of aromatic azido compounds. After he joined the Nippon Electric Company (NEC), he moved to the Government Industrial Research Institute, Tokyo in 1969, and became a leader of the laser-induced reaction group in 1983. The Institute was reorganized to the National Institute of Materials and Chemical Research (NIMC) in 1993 and then to the National Institute of Advanced Industrial Science and Technology in 2001. Since 1995, he is a chief senior researcher. His current research work is focused on material science on excimer laser processing, with special interest in detecting and characterizing reactive intermediates prepared in low-temperature matrix by photolysis and excimer laser ablation of organic molecular systems.

Since the first reports on laser ablation of polymers by two (i.e., Namba's and Srinivasan's) groups in 1982, laser ablation has been extensively studied to elucidate physical and chemical characteristics of the phenomenon, and to develop a new technology applicable to micromachining for plastics and to surface modification by using morphological changes of the ablated surface of polymer films.

Dr. Yabe's group has been one of the pioneering groups in these ten years in studying morphological change and microstructures of various polymer films. Niino and Yabe succeeded in observing characteristic microstructures of amorphous, semicrystalline biaxially stretched, and mono-axially stretched films of poly(ethylene 2,6-naphthalate) by excimer laser ablation. They further investigated chemical and physical aspects on laser-ablated surface of poly(ether sulfone) film, and revealed that the microstructure formation was induced by a polarized laser beam, and the resulting microstructures could align liquid crystals. Chemical reactions on laser-ablated surface of poly(ethylene terephthalate) and polypropylene were their another topics to immobilize reactive species and to modify surface characteristics. In addition, they succeeded in metallization on the laser-ablated polymer surfaces, as being evidenced from careful observation of surface potential before and after ablation.

Based on the experimental understanding, their projects extended to composite materials which were composed of organic and inorganic substances. They irradiated ns-, ps-, and fs-UV laser on the composites composed of elastomer

and carbon black, and observed selective ablation of elastomer and aggregation of carbon black on the ablated surface. These experimental findings are well understood in terms of thermal effect induced by different pulse durations (from ns to fs) of the laser beam, and the formation of the carbon-rich microstructures can be used to control the tribological character of the composite which are used as sealing and packing agents. In a series of these studies they succeeded in controlling the microstructure formation by using different wavelengths and pulse durations of laser beams, and developed a novel method to control tribological character of the composite materials. Their important researches have been presented at the annual Conference of Photopolymer Science and Technology and 14 issues of the papers have been published in Journal of Photopolymer Science and Technology. These contributions give the fundamental aspects of laser ablation of polymer films, and open a new application field of this novel technique.

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