The Photopolymer Science and Technology Award

The Photopolymer Science and Technology Award No. 122100, the Best Paper Award 2012, was presented to Haruyuki Okamura and Masamitsu Shirai (Graduate School of Engineering, Osaka Prefecture University) for their outstanding contribution published in Journal of Photopolymer Science and Technology, 24 (2011), 561-564, entitled "Reworkable Resin using Thiol-ene System".

Haruyuki Okamura received his B.S. degree in 1994, MS. degree in 1996, and Ph.D. degree in 1998 from Kyoto University for the study on synthesis and properties of fullerene-containing polymers with well-defined structures. He joined Osaka Prefecture University as a research associate in 1999. After being a visiting scientist (2009-2010) at Cornell University (USA), he was promoted to Associate Professor in 2011. His research interests include the synthesis of resist materials, photoacid generators, and reworkable resins. He is a member of the Society of Polymer Science, Japan.

Masamitsu Shirai received his B.S. and MS. degrees in applied chemistry from Osaka Prefecture University (OPU) and he became a research associate at the same university in 1973. He continued his doctoral studies at OPU in the field of polymer chemistry. In 1978 he received his Ph.D. degree from OPU on interaction between dyes and polyelectrolytes. After working as Assistant Professor and then Associate Professor at OPU, he was promoted to Professor of applied chemistry at OPU in 1997. He spent his early career as a postdoctoral fellow (1978-1979) at the State University of New York at Syracuse, USA. His research interests include synthesis and applications of photosensitive polymeric materials, especially photosensitive resist materials, photoinduced modification of polymer solid surface, and nanoimprint lithography.

The "reworkable" resins, which are easily removable after use, are getting more important in terms of environmental aspects. In this point of view, some thermosets which are thermally or chemically degradable under a given condition have been extensively studied [1-4]. They previously reported the photocurable resins which could be re-dissolved in solvents by thermal treatments [5-7]. The authors also reported the application of the reworkable resins as functional materials for nanoimprint lithography [8,9]. Difunctional (meth)acrylates are widely used as UV-curable monomers with high reactivity. However, curing reactions of the difunctional (meth)acrylates are strongly inhibited in the presence of oxygen. The oxygen inhibition was effectively suppressed by the use of thiol-ene photocuring system [10-12]. Thus, application of
Thiol-ene system affords high sensitivity to reworkable resins. In this paper, the authors report reworkable resins using thiol-ene system. Photo and/or thermal curing system which has reworkable properties was applied to the system. A reworkable monomer which have both methacryl units and degradable units is mixed with multifunctional thiols. Curing of the blends of the reworkable monomer and the thiols was carried out by irradiation at 365 nm in the presence of a photoradical initiator. Photo-induced acid generated from a photoacid generator induced the degradation of the cured sample by irradiation at 254 nm and the subsequent baking. Photocuring and thermal degradation behaviors of the reworkable resins are characterized using thermal analysis, Raman, and MS spectroscopy. A reaction mechanism of the curing and degradation of the resins is also discussed.

Their important research results have been presented at the Conference of Photopolymer Science and Technology 2011 and the paper has been published in Journal of photopolymer Science and Technology [13]. Their contributions give the fundamental aspects of development of new photocurable resins. They performed a pioneering work on reworkable resins.

Also, more than eighty issues of papers by Prof. Shirai’s group have been published in Journal of photopolymer Science and Technology. They have been devoting themselves to the progress of photopolymer science and technology.

References

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