The Photopolymer Science and Technology Award

The Photopolymer Science and Technology Award No. 061100, the Outstanding Achievement Award 2006, was presented to Masahiro Tsunooka (Osaka Prefecture University) for his outstanding achievements in photopolymer science and technology, "Development of Photoacid and Photobase Generators and Their Application to Design of Novel Photopolymers".

Masahiro Tsunooka

Masahiro Tsunooka is Professor Emeritus of Osaka Prefecture University. He received his M.E. degree from Osaka Prefecture University (OPU) in 1965. He was appointed as Research Associate at OPU in the same year. He received his Ph.D. degree from OPU in 1970 on Photo-polymerization and Photo-graft Polymerization. After being a postdoctoral fellow (1971-1972) at the University of Toronto (Canada), he was promoted to Associate Professor in 1973 and Professor in 1990 at OPU. He has retired in 2003 from OPU. Throughout his career, he has been engaged in polymer photochemistry, especially photodegradation and stabilization of polymers and photosensitive polymers including photoresists and UV curing materials. He has published more than 300 research papers including reviews and books. Many articles have been published in Journal of Photopolymer Science and Technology.

During his career, Prof. Tsunooka has contributed to the progress of photopolymer science and technology. His research interests include development of photoacid generators and photobase generators and their applications to photopolymers.

He has developed photoacid generators based on imino sulfonates and phenacyl sulfones. Imino sulfonate compounds are generally synthesized from oximes and sulfonyl chlorides. Many types of oximes can be derived using different types of ketones. Since the absorption characteristics strongly depend on the structure of the oxime moiety, photoacid generators sensitive to g-line, i-line, and deep UV light can be prepared. Using different type of sulfonyl chlorides, he obtained novel photoacid generators which can generate acids with different acid strength. He has also clarified the mechanism for the photolysis of the photoacid generators.

Development of photobase generators was a major part of his work. He developed many types of photobase generators based on oxime esters of carboxylic acids or phenacyl ammonium salts. Those photobase generators can generate primary-, secondary-, and tertiary amines. Although

photobase generators are not commonly used in industry at present, if compared with photoacid generators used in chemically amplified resist systems, photobase generators are in great demand for UV curing systems. I-line sensitive photobase generators are essentially important for the practical use. He has accomplished the photosensitization technique using triplet sensitizers.

Photoacid generators and photobase generators are key materials for photopolymers. He has applied those materials to photosensitive polymers, including photoresists and UV curing materials. Photochemically generated acids and bases can work as a catalyst for the crosslinking reaction of polymers and oligomers containing epoxy moieties. He has designed many types of photocrosslinking systems, including polymers and oligomers bearing both epoxy units and photoacid generating or photobase generating moieties in the side group. Polymers bearing carbamoyloxyimino (COI) moieties are photo-thermally crosslinkable. The COI unit is a blocked isocyanate and it can generate primary amine on UV irradiation. He has developed a highly sensitive photocrosslinking system based on addition reaction of photochemically generated

amines and isocyanates generated on baking.

Since crosslinked polymers are insoluble and infusible networks, scratching or chemical treatments with strong acids or bases must be applied to remove these networks from substrates. Thus, crosslinked polymers are generally difficult or impossible to thoroughly remove without damaging underlying materials. He designed novel photocrosslinkable systems bearing thermally degradable properties. On baking, the crosslinked polymers became soluble in solvents, in some cases in water or aqueous alkaline solutions. Those photosensitive polymers are friendly environment materials and can be used as reworkable materials.

Prof. Tsunooka performed a pioneering work on photoacid generators and photobase generators and their applications to photosensitive materials. He has been devoting himself to the progress of photopolymer science and technology.

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