

**The Second Green and Sustainable Chemistry Award
Awarded by the Minister of Environment**

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***“The Development of the Manufacturing Technology of New Environment-friendly
Five-ring Fluorine Compounds”***

The curb of stratospheric ozone depletion and global warming is our major global environmental issue. To cope with this issue, we have already gained some good results, including the total abolishment of chlorofluorocarbon production among developed nations by the end of 1995. However, it still has been our urgent task to develop a new generation fluorine compound, which has no ozone depletion effect and low impact on global warming, due to the fact that most of the ever-developed alternative chemicals as countermeasures for ozone depletion have a profound impact on global warming.

The essence of this work, “the development of the manufacturing technology of new environment-friendly five-ring fluorine compounds,” is the practical application and manufacturing technology development of two unique fluorine compounds of a five-ring structure: heptafluorocyclopentane as a precision cleaning solvent; and octafluorocyclopentene as a dry etching agent for manufacturing semiconductor. These compounds have characteristics of zero ozone depletion effect and low impact on global warming. We have developed unique synthetic methods that shorten the manufacturing processes of these compounds. In the GSC view, the compounds prove their positive effects for potentially minimizing fluorinated wastes.

The main feature of this technology is compatibility of environmental suitability and high performance achieved by unique molecular design. Both products have high performance that responds to the cutting-edge realm owing to their innovative molecular structure featuring five-ring. One is being used worldwide as a dry etching agent for high integrated and leading-edge semiconductor manufacturing, and the other is used as a high precision cleaning agent for metal and electronic devices or used in polymer coating solvents. Both are making a significant social contribution for their higher performance than any other conventional fluorinated compound. The products, when reduced to practice, trickle down to etching equipment, cleaners, and the peripherals, thus contributing to the industry.

To date, many studies have been performed on expanded scope of the compounds developed through this work, their extended application as chemical materials, development of the next generation materials of environmental suitability and high performance using the accumulated manufacturing technologies, etc. Indeed, part of these is at its development stage toward practical application. Therefore, this work can be highly expected for its future expansibility.