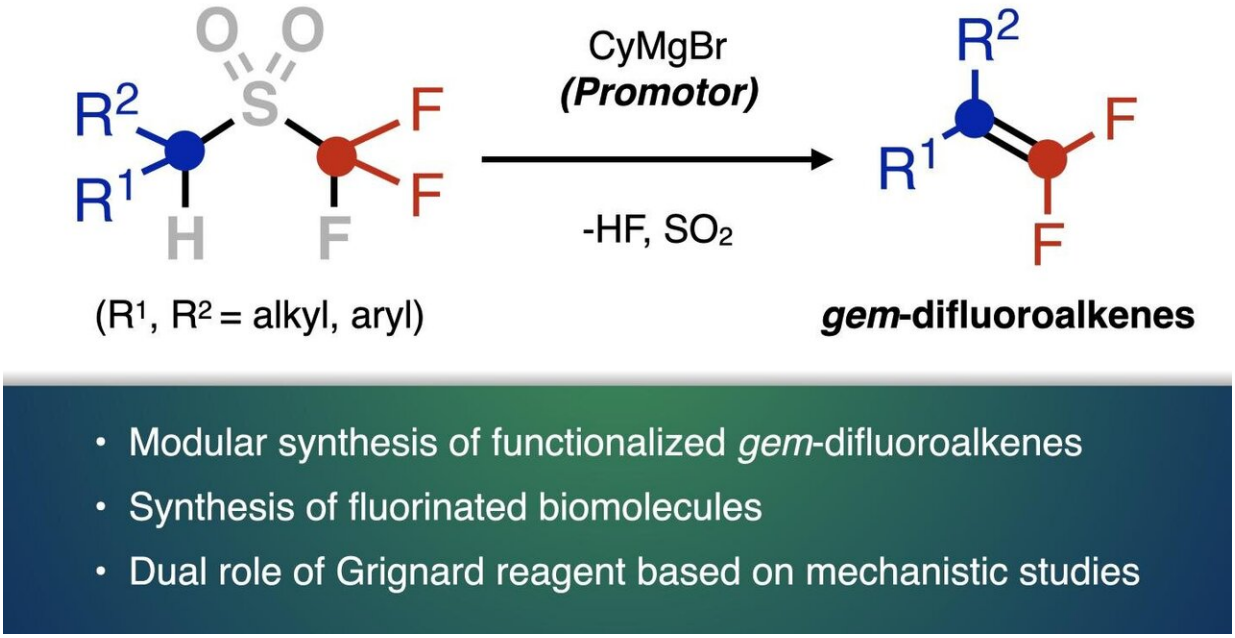
Establishment of a rapid synthesis method for useful organic fluorine compounds

September 9 2020



The reaction of triflones with the organic magnesium Grignard reagent allows for the synthesis of gem-difluoroalkenes Credit: Issey Takahashi

The Nagoya University Institute of Transformative Bio-Molecules (WPI-ITbM) research team of Professor Cathleen Crudden, Designated Lecturer Masakazu Nambo, JSPS Postdoctoral Fellow Yuki Maekawa and Associate Professor Daisuke Yokogawa have developed a new synthesis method for the efficient production of fluorinated alkenes.

This method offers a practical solution for the shortening of the synthesis process of existing bioactive compounds through the simple addition of an organic magnesium reagent, or Grignard reagent.

As bonds between carbon and fluorine are comparatively stronger than those between carbon and hydrogen, the addition of fluorine is known to increase stability in metabolism and oxidation. Thus, organic fluorine compounds are found in the majority of agrochemicals and organic materials, with their importance in this field only growing. 'Difluoroalkene' is the generic name for a compound with a structure into which two fluorine atoms have been introduced. Although a number of synthesis methods for difluoroalkenes have previously been developed, these often require the use of dangerously toxic and highly reactive fluoride reagents and are complex and multi-staged. Although some methods not requiring hazardous reagents have been reported in recent years, generic synthesis methods for particularly useful gem-difluoroalkenes have remained severely limited.

The research group aimed to develop a new synthesis method for fluorinated compounds using triflones, a variety of a group of organosulfur compounds called sulfones. They succeeded in carrying out a Ramberg-Bäcklund reaction to produce gem-difluoroalkenes, reacting triflones with an organic magnesium (Grignard) reagent. As a variety of carbon substituents can be introduced to the raw material of the triflone, this method greatly speeds up the previously very challenging gem-difluoroalkene synthesis process.

This method represents a great step forward for synthesis strategies in organic synthetic chemistry. Its ability to use easy to obtain and prepare reagents means that it is expected to find widespread use and contribute to the discovery of new agrochemicals and organic materials.

More information: Yuuki Maekawa et al, Alkyltriflones in the

Ramberg–Bäcklund Reaction: An Efficient and Modular Synthesis of gem-Difluoroalkenes, *Journal of the American Chemical Society* (2020). DOI: 10.1021/jacs.0c07924