

Methanofullerenes from Cycloaddition to C₆₀

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Abstract

The most prevalent method of fullerene core functionalization is (2+1) cycloaddition. The most promising of them are those that lead to methanofullerenes. They are created *via* the thermal addition of diazo compounds and the Bingel process of nucleophilic cyclopropanation. Discussion is held regarding the main cyclopropanating agents employed in the synthesis of mono-substituted methanofullerenes, ideal circumstances and the mechanism of the (2+1) cycloaddition, as well as the functional use of the target products.

The fullerene core is now being functionalized by scientists using high selectivity and yield technologies. With the electron deficient C₆₀ radical inclusion nucleophilic addition, and cycloaddition may all be accomplished fast.

Keywords: Cyclopropanation; Cyclopropanating; Monosubstituted; Nucleophilic; Electron-deficient

Description

In this situation, the driving force of the reactivity should be seen as the decrease in strain in the fullerene core. The most promising methods for functionalizing fullerene spheres are the (2+n) cycloaddition processes, where n can be between 0 and 4. Synthetic organic chemists prefer the (2+1) cycloaddition because it yields methanofullerenes, fullerenoaziridines, and fullerenoxyranes.

These reactions, which can call for a number of reaction processes, can use the addition of stabilised carbanions, carbenes, and nitrenes, for instance. In the early years of rigorous research on reactions of cycloaddition to C₆₀, the search for diverse addends for various cycloaddition variations as well as the identification of the essential regularities of these processes were of significant interest. However, the patterns of investigations have lately evolved.

The discovery of fundamentally novel cycloaddition reagents, the focused synthesis of fullerene derivatives with distinct properties, and in-depth research into multiaddition procedures and polycyclic adduct qualities are the main areas of focus right now. Methanofullerenes are one of the most popular (2+1) cycloaddition reactions that are preferred by the majority of researchers studying C₆₀ functionalization techniques. The two main synthetic processes for producing methanofullerenes are the Bingel reaction and adding diazo compounds at high temperatures with subsequent N₂ release.

The best method for producing methanofullerenes is the Bingel reaction, which includes cyclopropanation of C₆₀ with stabilised halocarbanions. It's almost adaptable; methanofullerenes of different structures can be made quite quickly when reactive methylene is present in halo-substituted substrates and base assistance. It is believed that the intramolecular replacement of the halogen atom by an anionic centre (which is produced on the fullerene sphere) takes place after the nucleophilic addition of a halocarbanion to C₆₀.

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In the first version, cyclopropanation takes place when C_{60} is treated with 2-bromomalonic ester in the presence of a base; the reaction is swiftly finished, and yields are typically robust. The cyclopropanating agent must first be halogenated, which is an additional step in this process. Typically, a mixture of mono- and dihalo-containing compounds that is difficult to separate is the end product.