Lanthanum Endohedral Metallofulleropyrrolidine: Synthesis, Isolation and characterization

Akinori Yomogita, Baopeng Cao, Takatsugu Wakahara, Takahiro Tsuchiya, Takeshi Akasaka*
Center for Tsukuba Advanced Research Alliance, University of Tsukuba, Tsukuba, Ibaraki 305-8577, Japan

Yutaka Maeda
Department of Chemistry, Tokyo Gakugei University, Koganei, Tokyo 184-8501, Japan

Kaooru Kobayashi, Shigeru Nagase
Institute for Molecular Science, Okazaki 445-8585, Japan

Tatsuhisa Kato
Faculty of Science, Josai University, 1-1 Keyakidai, Sakado, Saitama 350-0295, Japan

Endohedral metallofullerenes; molecules with a positively charged metal core surrounded by a negatively charged carbon cage, present unique structure and novel properties together with considerable potential application perspectives which arise from the incarcerated metal and are not expected for the empty fullerenes.[1]

Driven by their novel structures and properties, limited cases of organic functionalization of metallofullerenes have been reported. Relative to metallofullerenes, organic derivatization of C60 has been extensively investigated. Among the successful functionalization methodologies, the 1,3-dipolar cycloaddition of azomethine ylides to C60 has been broadly accepted and referred to as the Prato reaction.[2] The fulleropyrrolidines thus formed present novel properties that are absent for their pristine C60.

We report for the first time synthesis of lanthanum endohedral metallofulleropyrrolidines (1) through addition of an azomethine ylide (2) to La@C82-A.[3] Metallofulleropyrrolidines (1) have been isolated by HPLC chromatography and characterized by means of mass spectrometry, UV/Vis-NIR absorption, and ESR spectroscopy. Formation of N-substituted fulleropyrrolidine will also be presented.

CH3N=CH2+CH3COONa → CH3 COONa

[CH3CO]2 + La@C82-A → CH3 COONa

Toluene, reflux

[CH3 COONa]2 + La@C82-A → CH3 COONa

n = 1, 2