

Research Program of Atom Endohedral Fullerenes in Tohoku University Japan

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In 1990 ISSPIC conference in Konstanz, mass production and isolation of fullerenes were reported for the first time by Krätschmer and his coworkers [1]. Since then, the present chemistry and physics of nanocarbons has been studied including fullerene, nanotube, and graphene. Atom endohedral fullerenes have also been studied for more than 25 years. In 2010, researchers in Tohoku University, Idea International Co. Ltd. and their coworkers succeeded in mass production of $\text{Li}^+\text{@C}_{60}$ salt by plasma method [2]. As shown in Figure, this method has a technical advantage due to the high concentration lithium-ion having uniform energy and was possible to achieve precise control of the plasma [3]. Now the solid sample of $[\text{Li}^+\text{@C}_{60}](\text{PF}_6^-)$ can be purchased from Idea International Co. Ltd [4].

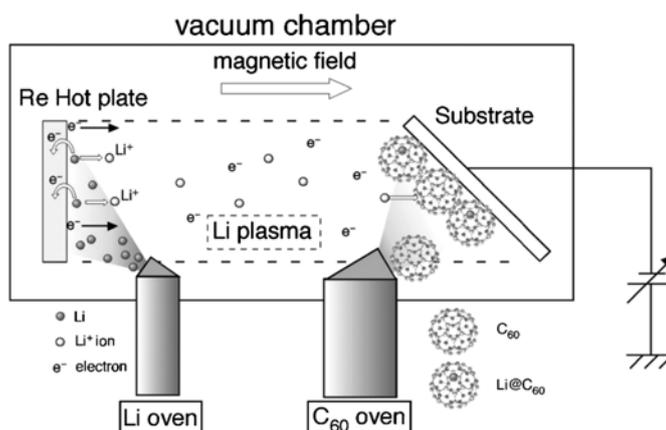


Figure. Schematic diagram of the production apparatus for endohedral fullerene containing Li [3]. Li^+ ions produced by contact ionization are supplied together with C_{60} molecules onto a metal substrate. The ions are accelerated by negative potential applied to the substrate, and a suitable amount of C_{60} is generated from a heated oven by sublimation.

From 2015, the research program “Creation of International Research Center for Atom-Endohedral Fullerene Nanobionics” was selected as a Program for Key Interdisciplinary Research in Tohoku University, Japan. This program covers synthesis, analysis, functionalization, and application of the atom-endohedral fullerene. The mass production of these new materials enables us to develop not only new concept nano-electronics device but also novel application to biotechnology, medical treatment, drug discoveries, and so on.

Moreover, the “Center for Fundamental and Applied Research of Novel Nanocarbon Derivatives” was recognized in April 2016 by Tohoku University based on the above program. This project is aiming at the establishment of a world-class research center dedicated to the field of the nanocarbon science.

- [1] W. Krätschmer, et al., *Nature* **347**, 354 (1990). [2] S. Aoyagi et al., *Nature Chemistry* **2**, 678 (2010).
[3] H. Okada et al., *RSC Advances*, **2**, 10624 (2012). [4] <http://www.lic60.jp>