Isomer Determination for Individual Molecules by High Resolution Electron Microscopy with Atomic Sensitivity

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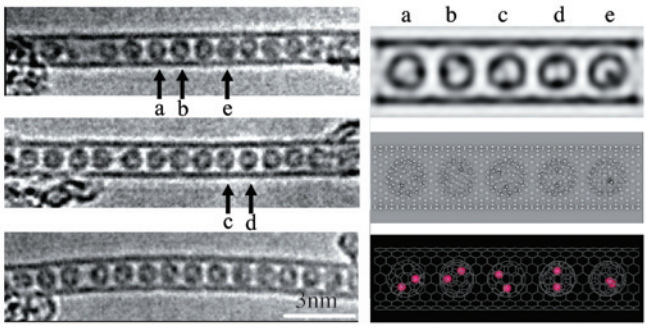
Intra-molecular structure of the scandium di-metallofullerene ($Sc_2@C_{84}$) has been clearly revealed by high resolution transmission electron microscopy (HR-TEM) with the single atom sensitivity. Direct observation of two Sc atoms inside each fullerene molecule has led to a successful determination of the molecular symmetry among the three possible structural isomers for the $Sc_2@C_{84}$. The present work introduces a new electron microscopic approach to investigate individual molecular structures and demonstrates the possibility for determining the molecular isomer on a single-molecular basis.



(Left) HR-TEM images of the $Sc_2@C_{84}$ metallofullerene inside SWNTs. Dark spots seen in each molecule correspond to the individual Sc atoms. (Right) Simulated HR-TEM image (top) for various orientations of $Sc_2@C_{84}$ molecules inside SWNT. Projected atomic potential (middle) and models used for simulations (bottom) are also presented. Legends (a-e) correspond to those in the observed HR=TEM images.

Decomposition of Environmentally Persistent Perfluorinated Compounds by Heteropolyacid Photocatalysts

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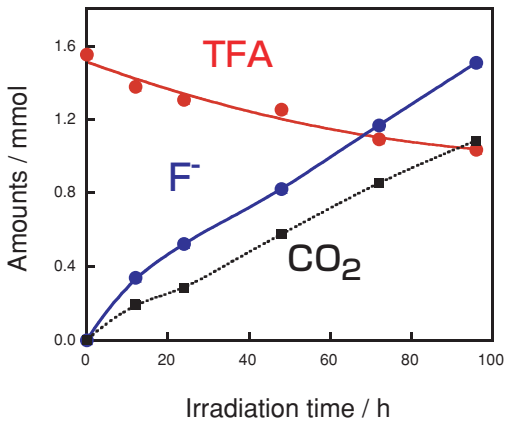
Fluorinated compounds have been widely used in industrial applications such as surfactants. The use of these compounds has steadily increased, and some of them have detected in the environment. Hence, it is desirable to develop an artificial method for decomposing these compounds to environmentally harmless species under mild conditions as a measure against stationary sources.

We developed the effective decomposition method for perfluorinated compounds such as trifluoroacetic acid (TFA), using a homogeneous system consisting of the heteropolyacid photocatalyst, water, and oxygen. Most of the F and C atoms in the decomposed TFA are transformed into F- and CO_2.



Irradiation-time dependence of the TFA decomposition [Reprinted with permission from Environ. Sci. Technol. 2003, 37, 418. Copyright 2003 American Chemical Society].