

The Role of Precise Structure Analysis for Molecular Crystal System

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If you use the high-intensity nature of synchrotron radiation X-ray, a structure analysis can be conducted by micro crystals or an ultralow volume powder specimen. In the research of a new material science, it is regarded as one of the very important tools of analysis. However, the use of X-rays of the synchrotron radiation is not only extensible of the range in the state of the sample that enables the crystal structure analysis but also enables the electronic state to be observed. Here, it introduces the recent results of the structure analysis on molecular crystals in Photon factory, and it proposes next directionality.

The contents which should be introduced first are the electron density analysis of the fullerene which contained the single hydrogen molecule. The Komatsu group of Kyoto University succeeded in incorporation of a H₂ molecule in 100% into a C₆₀[1]. A precise analysis using the synchrotron radiation diffraction was able to observe containing a hydrogen gas molecule in the open-cage C₆₀ (middle synthetic stage) [2] and complete C₆₀ (final stage as H₂@C₆₀). The synchrotron radiation clarified utility in the field of research of the Nano material to these results again.

Another big result is observation of a charge order state in molecular conductor systems. From the viewpoint of the cooperative relations between the theorists and the experimenters, and between the chemists and the physicists, the field of the molecular conductor research field in our country forms the research group which does not look at a kind in the world.

Recently, the many results of following were obtained in Photon Factory; the observation of various electronic phases in BEDT-TTF salts and their derivative molecular salts[3], the observation of the exotic electronic state in MMX and their derivatives[4], the determination of “electron crystal” so-called Wigner crystallization in one-dimensional molecular conductor[5].

These results of Photon Factory lead to the exploitation of the principle of new physics instead of mere identification. Thus, the role of synchrotron radiation X-ray is important for development of the field of a molecular crystal science.

References

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