International Conference on Nanospace Materials 2025@Nagano

Kei Kubo, Otsuka, Daisuke Saeki, Furuse Ayumi, Hayashi Takuya, Toshio Sakai and Kaneko

Affiliation Institute of Aqua Regeneration, Faculty of Engineering

E-mail: kk18ss305h@shinshu-u.ac.jp (Kei Kubo),
kkaneko@shinshu-u.ac.jp (Kaneko Katsumi)

Ultramicropore analysis of carbon-based nanoporous material with PALS method

Positron annihilation lifetime spectroscopy (PALS) is used to analyze ultramicropore structures of various Si-based materials[1]. The probe size of the positronium of the PALS is only 0.1 nm and thereby the PALS analysis of ultramicropores of porous carbons is strongly requested for promotion of energy storage technologies. However, the applicability of PALS to carbon materials is not necessarily well established. We must obtain the key parameter of δ associating with the effective electron cloud thickness of carbon materials for the positronium using well-characterized carbon samples such as single wall carbon nanotube (SWCNT).

The SWCNT bundle has two kinds of pores of the internal tube space and interstitial space. The sizes of the inside tube space and the interstitial subnanoscale space (ISS) can be determined by Ar adsorption at 87 K and X-ray diffraction (XRD). Consequently, PALS measurements of two kinds of SWCNT bundles having different tube diameters enable to determine the key parameter of δ for PALS analysis of carbon materials. The average widths of internal tube spaces and ISS of two kinds of SWCNT bundles were determined by XRD and Ar adsorption. Thus, we determined δ = 0.23 nm for carbon materials.

We applied the PALS method to reduced graphene oxide (rGO) using δ = 0.23 nm. The PALS analysis gave new pore information on rGO. We will discuss the physical meaning of the obtained pore sizes from PALS at the conference.

References

1) T. L. Dull and D. W. Gidley *et al.*, *J.Phys.Chem.B*, **105**, 4657, (2001).