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Simultaneous measurement of SAXS and absorption factor by use of Si PIN photodiode installed in direct beam stopper (2)

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Introduction

Small-angle X-ray scattering (SAXS) pattern and the magnitude of the scattering intensity sensitively depend on correction of background intensity and of absorption, both of which are made by use of absorption factor, μl, where μ is the linear absorption coefficient of a sample and l is its length. Here, we report the apparatus for measurement of the factor by use of photodiode installed in a direct beam stopper. Our method for the determination of the factor, which is simply constructed by a beam stopper with a pinhole and a one dimensional detector, was described previously.[1] However, the method is not enough in stability and accuracy. Although another method has been tried using two ionization chambers, this method increases background due to path of ionization chamber, or we have to obtain SAXS signals and the absorption factors by turns. The new method is superior in an *in-situ* measurement of SAXS intensities and absorption factor of the sample.

Experimental

The transmittance of direct beam was monitored by silicon PIN photodiode (Hamamatsu Photonics, S5106) connected to a pico-ammeter (Keithley Instrument, 6485). The detector was covered with aluminum foil to shut out room light, and cupper sheet was set on the photodiode to attenuate X-ray intensity to proper intensity for the detector. Since surface of the detector is larger than the cross section of direct beam, the detector was covered with lead sheet to cut scattered X-ray. Figure 1 shows photograph of the detector set at frame in vacuum chamber of BL-15A. The distance between sample and detector was about 2 m. Incident X-ray intensity was monitored by ionization chamber.

It takes one minute to be stable intensity of X-ray after open the shutter. After stabilizing intensity of X-ray, the signal was flowed as follows: the Picoammeter-V/F converter-counter.

Simultaneous measurement of SAXS and absorption factor was carried out for super critical CHF_3 along an isotherm at 311.4 K and pressures between 4.08 to 8.25 MPa.

Results and Discussion

Figure 2 shows the measured absorption factor, μl, at various densities of super critical CHF_3. As shown in Fig. 2, the measured μl shows good proportional relation to density. This indicates that the measurements were accurately performed in wide density range. This method is applicable to other samples. This apparatus enables us simultaneous measurement of SAXS intensity and absorption factor of a sample.

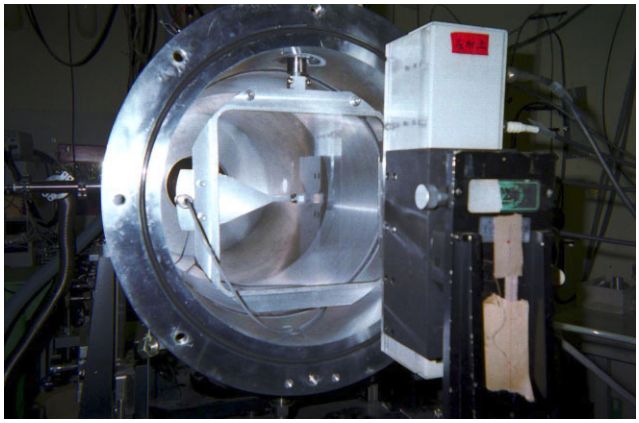

Fig. 1 Photograph of the detector set at frame in vacuum chamber of BL-15A.

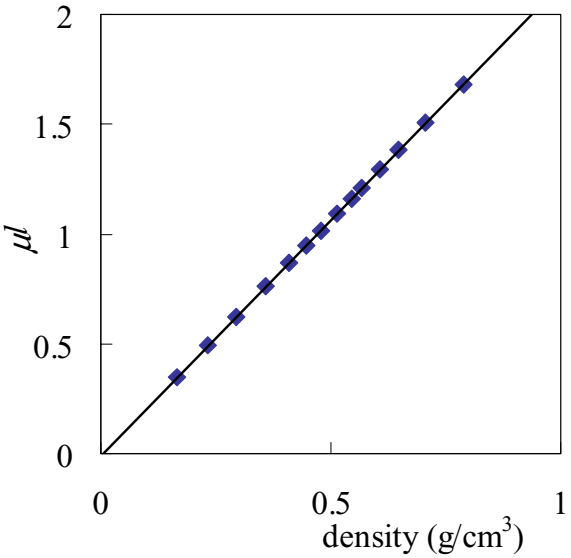

Fig. 2 Relation of absorption factor, μl, and fluid density of super critical CHF_3 measured by Si PIN photodiode installed in a direct beam stopper.

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References

[1] K. Nishikawa et al., *J. Phys. Chem.*B, *101*,1413(1997).

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