



## Sulfur-encapsulation in graphene nanospace

Shuwen WANG, Hedeki TANAKA  
信州大学工学部先鋭材料研究所 (RISM)

キーワード : Small angle X-ray scattering, Porod plot, Amorphous disorder

### 1. 背景と研究目的

Small angle X-ray scattering (SAXS) analysis is a facile and useful method to determine structures of non-crystal material. We have prepared two dimensional confined nanospace (PG-box) and encapsulate sulfur into such nanospace. It is of significant importance to investigate the structure of confined sulfur, which is different from its bulk state.

### 2. 実験内容

We prepared a two-dimensional confined nanobox and encapsulated sulfur into such nanobox. High-resolution, small-angle, synchrotron x-ray-scattering techniques were used to determine the structural information of sulfur inside nanobox. The SAXS patterns of sulfur-contained PG-box was obtained in Aichi SR. The analysis was performed by transforming the SAXS data into Porod plot.

### 3. 結果および考察

Figure 1 shows the SAXS profiles of PG, PG-box, and sulfur encapsulated PG-box prepared at 500 °C and 580 °C. These represent a method for defining the Porod final slope  $K$ , when the intensity scattered by the internal surfaces varies as  $1/q^4$  plus a constant  $b$  that represents local amorphous disorder in the atomic structure, as in a liquid. In this region of the spectrum the intensity is therefore

$$I(q) = K/q^4 + b,$$

so that by plotting  $I(q)q^4$  vs  $q^4$  in a linear scale we should get a straight line with intercept  $K$  and slope  $b$ .  $K$  is important in estimating the internal surface area. In the samples PG and PG-box, the straight line region is not yet reached, but for the other two samples it does seem to be the case. It is

notable that in sample S580-PGbox the slope of the curve is zero, or at least very small (this corresponds to the fact that the high  $q$  slope for this sample is almost -4). By implication, this sample displays very little liquid-like disorder (although the shape of  $I(q)$  at lower  $q$  indicates some disorder on a larger scale).

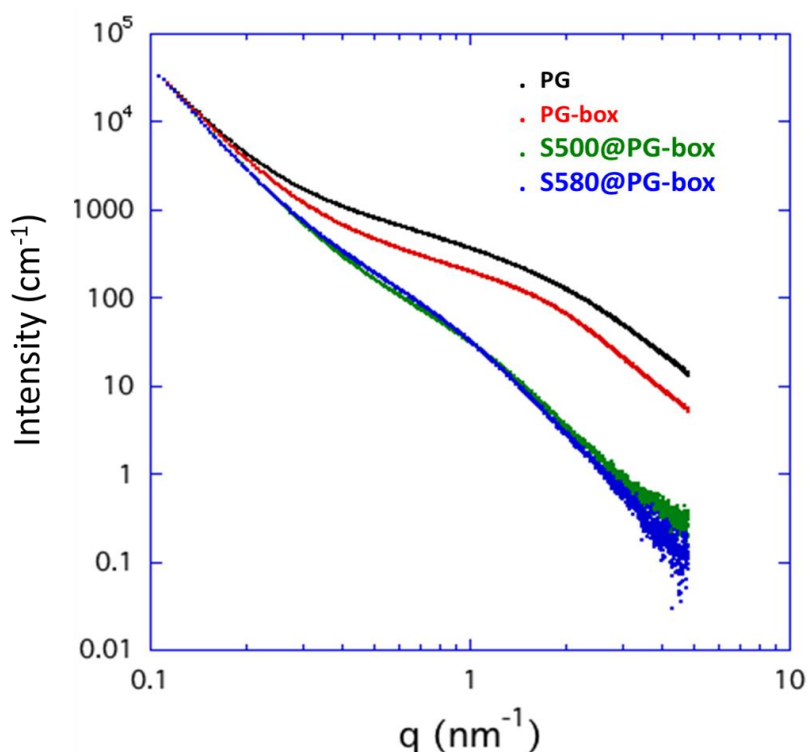


Fig. 1 SAXS profiles of PG, PG-box, and sulfur encapsulated PG-box prepared at 500 °C and 580 °C.