

Fig. 2 scattering intensity at different energies of the primary beam

Fig 2. shows the first result of the measurement: The scattering intensity changes remarkably for the same sample when changing the energy of the primary beam.

Near the adsorption edge, the scattering factor becomes a complex quantity  $f = f_0 + f'(E) + i f''(E)$ . Hence, one can split the scattering intensity into three terms [3]:

$$I(q) = F_0^2(q) + 2f'(E)F_0(q)v(q) + [f'(E)^2 + f''(E)^2]v^2(q)$$

Model calculations [3] show that the self-term of the counterions,  $v^2(q)$ , is negligible compared to the both other terms. If one subtracts two energies from each other, the constant term  $F_0^2(q)$  (contains the contribution of the macroion and the constant part  $f_0$  of the counterions) should vanish. The remaining cross term should scale with the difference of the  $f'$ -values. Fig. 3 demonstrate this behaviour for the experimental data for three different pairs of energies. Calculating of this behavior is a test for the model calculations saying  $v^2(q)$  is negligible and a test for the absolute intensities if the scattering experiment.

Eq. (1) shows that measuring at two energies gives the cross-term  $F_0(q)v(q)$ . On the other hand, measuring far below the edge where  $f'$  and  $f''$  are negligible gives directly  $F_0^2(q)$ . Neglecting problems of polydispersity which is justified for the extremely small polydispersities of the samples examined here one can experimentally determine the scattering  $v^2(q)$  of the counterions alone, just by calculating the square of the crossterm, divided through  $F_0^2(q)$ . Fig 4. shows the experimental result and a fit that describes both terms,  $F_0^2(q)$  and  $v^2(q)$ . Therefore it was necessary to assume a similar scattering length density distribution for the polyelectrolytes and for the counterions as shown in the inset of fig.4.

In conclusion: ASAXS gives the possibility to determine the scattering of the counterions alone. Hence, it is possible to distinguish between the distribution of polyelectrolytes and counterions by measuring only one system at different energies. In the present system the radial distribution of counterions and polyelectrolyte chains seems to be nearly the same which shows the strong correlation caused by the electrostatic interaction. A more detailed analysis and a first publication are in preparation.

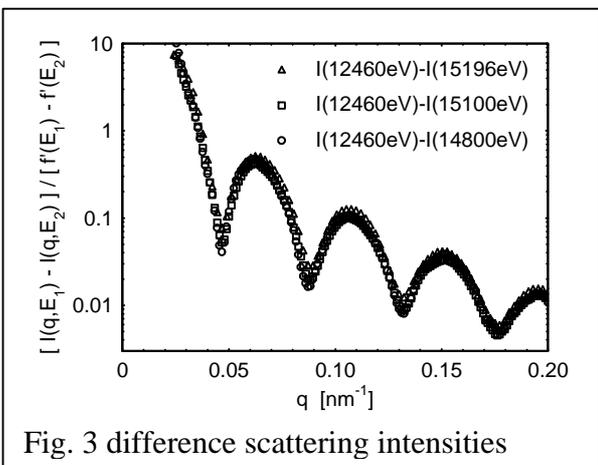


Fig. 3 difference scattering intensities

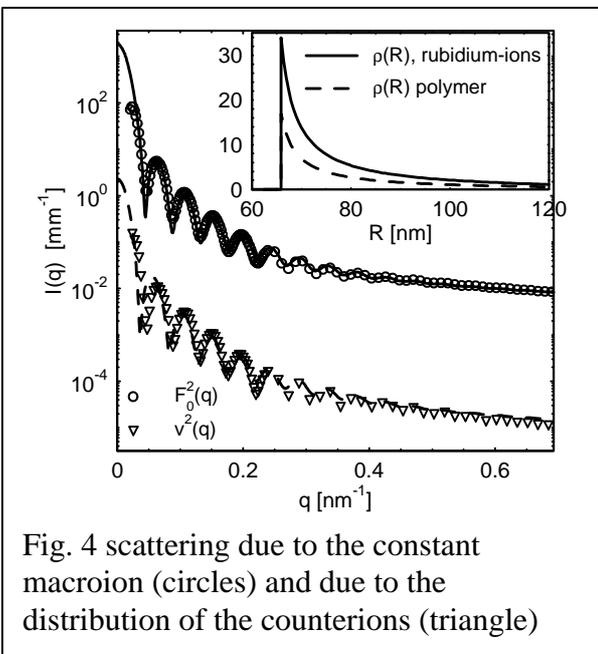


Fig. 4 scattering due to the constant macroion (circles) and due to the distribution of the counterions (triangle)

1. Guo X, Ballauff M (2000) *Langmuir* **16**, 8719
2. Guo X, Ballauff M (2001) *Phys Rev E* **64**, 51406
3. De Robillard Q, Guo X, Dingenouts N, Ballauff M (2001) *Macromol Symp* **164**, 81