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Effect of ions on structure of dehydrated NIPA/SA gel

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Introduction

Gel consists of 3-dimensional polymer network and solvent. Therefore, it is expected that the gel shows interesting property evolution when the solvent is being taken away.

Recently, we revealed, by a small-angle x-ray scattering (SAXS) study, that a *N*-isopropylacrylamide /sodium acrylate (NIPA:hydrophobic, SA:hydrophilic) gel exhibits microphase separation by dehydration[1]. From the results of the further SAXS experiments [2], we have estimated an occurrence mechanism for the microphase separation as follows: because the network of the NIPA/SA gel consists of the hydrophobic (NIPA) and hydrophilic (SA) moieties, the solvent (water) can not evaporate homogeneously via the different interaction degrees with the NIPA and SA parts in the gel network, therefore as a result, a heterogeneous structure like the islands in the sea can be generated.

In this line, it is expected that the NIPA/SA gel could absorb metal ions into the islands and, by the dehydration, the metal ions could be concentrated there.

Here, we report the mesoscopic structure of the NIPA/SA gels with the various kinds of metal ions observed by the SAXS method.

Experimental

We prepared for eight kinds of the dehydrated NIPA gels with different metal ions; Na, Mg, K, Ca, Rb, Sr ions. The ratio between NIPA and acrylate acide for all gels is 4:3.

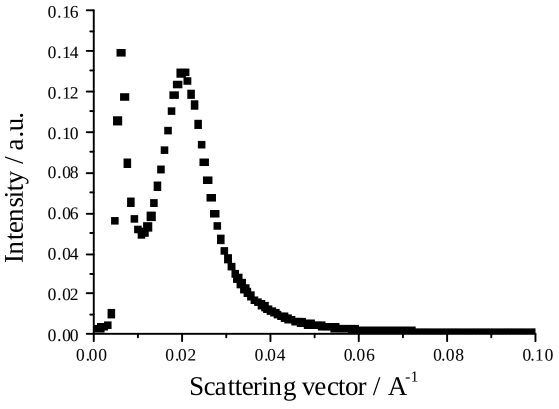

Fig.1. SAXS profile of the dehydrated NIPA gel with potassium ion.

Figure 1 shows SAXS profile of the dehydrated NIPA gel with potassium ions. As you can see, a distinct peak is observed at 0.020 A^{-1}. The peak position indicates the size of the cluster where the metal ions are aggregated. The similar peaks are observed at slightly different positions in all samples.

Here we are interested in the relation between the metal ion species and the size of the cluster. Therefore, we examined the peak positions in the SAXS profiles for the ion radius of the absorbed metal ion. The result is shown in Fig.2. The peak positions become small with decrease of the ion radius. This means that the size of the cluster become large with the decrease of the ion radius.

More detailed analysis is now in progress.

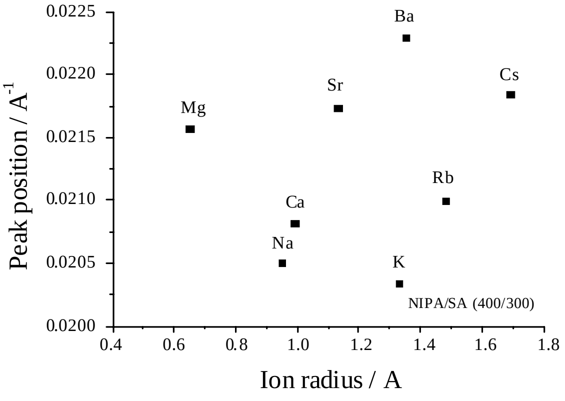

Fig.2. Peak position distribution of the dehydrated NIPA gels for the ion radius of the absorbed ions.

References

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