NW10A/2006G314

Local structure of rubidium ion in ion-exchange resins

Mutsumi SAITO*[1], Yoshitaka HIGASHI[1], and Hideto SAKANE[2]
[1]Interdisciplinary Graduate School Med. Eng., Univ. Yamanashi, Kofu, Yamanashi 400-8511
[2]Center Instr. Anal., Univ. Yamanashi, Kofu, Yamanashi 400-8511

Introduction

Ion-exchange resins have been widely used for treatments of waste solution, desalting, etc., but local and hydration structures of ions in the resins are seldom studied. Although organic ion-exchangers contain many elements of hydrogen, carbon, oxygen, etc., XAFS can be measured because X-ray absorption spectrum is almost unaffected by the polymer matrix and solvents when heavy elements were chosen as the counter ion. Therefore XAFS is a suitable method for the objective of examining ion-exchange resins. This study is aimed to reveal the relationships between exchange properties and the structures.

Experimental

Organo Amberlite IR120B, 200CT, and IRC76 were pretreated such as grainding, homogenization of particle size, washing with ethanol, NaCl and HCl aqueous solution and then ion-exchanged with RbCl aqueous solution of different concentration among [Rb^+]:[H^+]=10:0 to 2:8 and for 80% and 100% of exchange ratios.

Rb K-edge X-ray absorption spectra were measured at PF-AR NW-10A for the wet resin samples that were stored in plastic bags and supported between stainless steel holders. Measurements were under transmission mode and room temperature. For comparison use, 0.1 mol/L RbCl aqueous solution and some Rb salts powders were also measured.

Results and Discussion

Fourier transforms for IR120B, 200CT, and IRC76 resins exchanged for [Rb^+][H^+]=10:0 aq. sln. are shown in Figs. 1 to 3, respectively. The peak position of all Fourier transforms are listed in Table 1. Though both resins are strong acidic, small differences on the peak position are observed for IR120B and 200CT. On the other hand, a weak acidic resin, IRC76, resembles IR120B in the peak positions. The peak positions for resins are different from that for RbCl aq. sln. Here two Rb^+ local structures can be assumed in the resins. One is the fully hydrated structure same as that in aqueous solution. The other is in contact with the functional group, sulfonyl or carboxyl group, and without any water molecules. The second structure should show short peak position in Fourier transform and, in the resins, both structure are mixed. In IR120B and IRC76, the ratio of the fully hydrated structure is higher than in 200CT because of their longer peak positions.

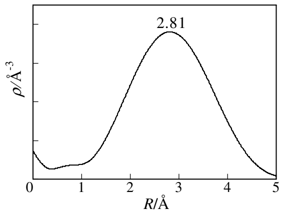

Fig. 1 Rb K-edge EXAFS Fourier transform for IR120B resin exchanged for [Rb^+]=10 mmol/L.

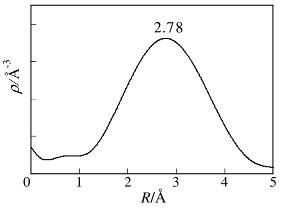

Fig. 2 Rb K-edge EXAFS Fourier transform for 200CT resin exchanged for [Rb^+]=10 mmol/L.

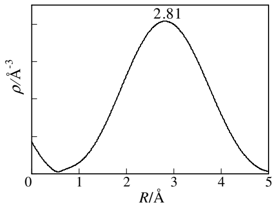

Fig. 3 Rb K-edge EXAFS Fourier transform for IRC76 resin exchanged for [Rb^+]=10 mmol/L.

Table 1 The peak position of Rb K-edge EXAFS Fourier transform for Rb^+-exchanged resins and standard samples.

Sample (resin)	Peak position / Å
IR120B	2.80-2.82
200CT	2.76-2.78
IRC76	2.81-2.83
Rb_2SO_4	2.82
Rb_2CO_3	2.67
CH_3COORb	2.84
mol/L RbCl aq.	2.86

---

* g06ma017@ccn.yamanashi.ac.jp