Synthesis of Lithium Ion Memory Exchangers for advanced adsorption-desorption and Their Application to Sea Water

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Summary

At a lithium symposium, the demand for lithium was described for energy applications such as lithium battery and thermonuclear fusion reactors. Several methods have been proposed for Li^+ recovery from sea water and brine, e.g., coprecipitation with insoluble compounds such as alminate and alminosilicates, solvent extraction, ion exchange method and so on. An ion exchange method using a commercially available ion exchange resin is not suitable because of very low selectivity for a small amount of lithium in a large quantity of other alkali metal and alkaline earth metal ions in the sea water.

In recent year, it has been found that some inorganic ion exchange materials such as l-MnO_2 and monoclinic antimonic acid etc. showed an extremely high selectivity for lithium ions. A comparative study has been made on the separation of lithium ions from sea water with various inorganic ion exchangers.

Especially, monoclinic antimonic acid shows lithium ion memory effect and an extremely high selectivity for lithium ions compared with other alkali metal ions. However, the disadvantage of this material is an extremely slow rate of adsorption and desorption for lithium ions.

The present study reveals the possibilities of improvement rate of the adsorption and desorption.

An attempt has been made for improvement of rate of desorption of lithium ions to form of solid solution introduced to niobate in the structure of lithium antimonate or to antimony lithium niobate. The samples were prepared by calcinating the mixture of Nb_2O_5, Sb_2O_3 and Li_2CO_3 with different ratios at 700°C or 900°C. The X-ray diffraction studies indicate formation of solid solution for the these materials for samples has low content of the composition lower than 0.2 mol fraction.

The rate of desorption of lithium ion in the samples was improved for the samples of the mole fraction lower than 0.1-0.2.