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Lithium Ion Sieve Preparation from Reduction-Ammoniacal Leaching Residue of Polymetallic Nodules

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ABSTRACT

The spinel lithium manganese oxide($Li_{1+x}Mn_{2-x}O_4(0<x<0.33)$) was prepared by solid state reaction from the reduction-ammoniacal leaching residue of polymetallic nodules and LiOH. The ion sieve was obtained by washing precursor with acid. The static saturated absorption capacity of ion sieve was up to 12.8 mg/g. The ion sieve had high selectivity to Li^+ and the sequence of distribution coefficient was following: $Li^+>>Na^+> K^+>Mg^{2+}>Ca^{2+}$. The separation coefficients of lithium-calcium and lithium-magnesium were 16756 and 35483 respectively. It was of great significance in comprehensive utilization and development of functional materials for polymetallic nodules..

KEY WORDS: Poly-metallic nodules; ion sieve; synthesis; transformation; adsorption; lithium; reduction-ammoniacal leaching residue.

INTRODUCTION

Many countries have done a lot of work on the ploy-metallic nodules exploration and suggested many extracting processes. The Beijing General Research Institute of Mining & Metallurgy(BGRIMM) has suggested a self-catalysis reduction-ammoniacal leaching process which can recover nickel, cobalt and copper effectively and comprehensively. BGRIMM is studying on functional materials produced from the reduction-ammoniacal leaching residue in order to achieve no-slag smelting and clean extracting of poly-metallic nodules.

Lithium is known as Energy Element in the 21st century. Now salt lake brine has been the main material to produce lithium products replacing lithium ore. About 80% of global lithium production comes from the salt lake brine. China is one of the countries abundant with modern salt lake resource. Lithium resource from salt lake accounts for 80% of the national lithium reserves in China and most of them are undeveloped.

In this paper the synthesis of lithium ion sieve by reduction-ammoniacal leaching residue is discussed which provides a new way to develope the lithium resource from salt lake in China.

EXPERIMENTAL

The TG-DTA Analysis of Reduction-ammoniacal Leaching Residue of Poly-metallic Nodules

The reduction-ammoniacal leaching residue of polymetallic nodules was of large specific surface area and well-ordered mesoporous. The residue contained 25-30% Mn and a little of silicon, iron and aluminum etc.(Table 1). The manganese minerals content was 50-60% in the residue, and 95% of manganese minerals was dialogite(Table 2). The remains in the residue were feldspar, quartz and amorphous hydroxides Fe(Fig.1).

The leach residue is a good source of Mn for lithium ion sieve, and also serves as a good support material for the sieve.

Table 1 Chemical Compositions of Reduction-Ammoniacal Leaching Residue

Component	Mn	Ni	Co	Cu	Fe
Weight%	26.86	0.021	0.025	0.03	5.81
Component	CaO	MgO	Al_2O_3	SiO_2	
Weight%	1.94	1.12	4.91	14.21	

Table 2 Mineralogical Compositions of Reduction-Ammoniacal Leaching Residue

	Mineralogical Compositions	weight%
Metallic minerals	dialogite	50.8
	residue MnOOH	2.5
	amorphous hydroxides Fe	12
Gangue mineral	Cross calcium zeolite	34.7
	Montmorillonite	
	feldspar	
	quartz	