Proceedings of The Eighth (2009) ISOPE Ocean Mining Symposium
Chennai, India, September 20-24, 2009

ISBN 978-1-880653-75-3; ISSN 1946-0066

Preparation of Lithium Ion Sieve from Polymetallic Nodules

Fan Yanqing, Jiang Xunxiong, Wang Shengdong, Zhao Lei, Jiang Kaixi and Feng Linyong
Beijing General Research Institute of Mining and Metallurgy
Beijing, China

ABSTRACT

The spinel lithium manganese oxide(LiMn2O4) is prepared by solid state reaction with the raw materials of polymetallic nodules and LiOH. The products are analyzed and described by means of XRD and electron-diffraction diagram. The results show that the optimal preparation condition is molar ratio 1.0 for Li/Mn, 600^{o}C for synthesis temperature and 6h for reaction time.The ion sieve is obtained by washing precursor with acid. The static saturated absorption capacity of ion sieve is up to 19.5 mg/g. The Kd (distribution coefficient of Li+) is far bigger than the Kd of alkaline metals and alkaline earth metals. The separation factors are quite large between lithium and potassium, magnesium, calcium etc, which means a very high selectivity. It is a breakthrough in producing ion sieve with natural mineral. It is of great significance in non-smelting and development of functional materials for polymetallic nodules.

KEY WORDS: poly-metallic nodules; ion sieve; adsorption; lithium

INTRODUCTION

Because of special environmental conditions, polymetallic nodules have many physico-chemical characteristics different from land based deposits, such as porous, tunnel, and sandwich structure, small interspace diameter (1-12 nm, most below 2 nm), high porosity (more than 50-60%), large surface area, ability to catalyse active transition elements and active silicon(Wang, 1986). It is very important to exploit these special physico-chemical characteristics for direct use of , polymetallic nodules. Studies on application of polymetallic nodule as a catalyst have been made in US, France and Japan.I Similar studies have also been carried out in Chinese laboratories since 1990s, but there has not been any commercial application (Sun, 2003). The key factor for non-conventional use of polymetallic nodule is its cost, and the cost for recycling.

One of the most promising methods to use polymetallic nodule ,without using it for metal extraction, is to exploit its physico-chemical properties for preparing lithium ion sieve.

THEORETICAL

TG-DTA figure of polymetallic nodules

The plots from thermal analysis of nodule (Fig 1) shows about 25.5% loss in weight upto 300 ^{o}C . This loss is mainly due to loss of free and bound moisture. The two peaks below 300 ^{o}C show loss of free moisture at 106.3 ^{o}C, and bound moisture at 153.6 ^{o}C The TG plots indicate little weight loss above 400 ^{o}C, though the DTA plot show several endo peaks. These peaks are possibly due to reduction of Mn(IV) to lower valency states, or due to loss of organics, or due to decomposition of carbonates.

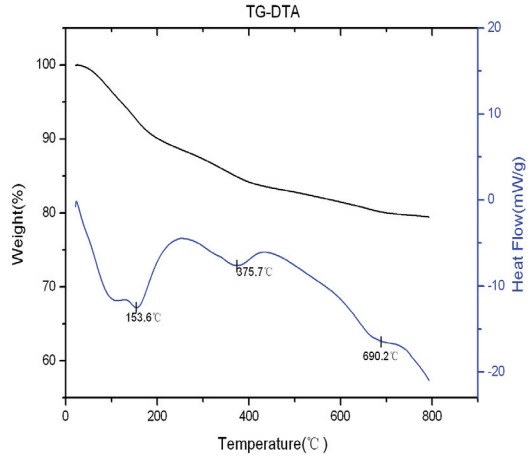

Fig.1 TG-DTA of polymetallic nodules

EXPERIMENTAL

The experiment is carried out following flow chart (Fig 2).

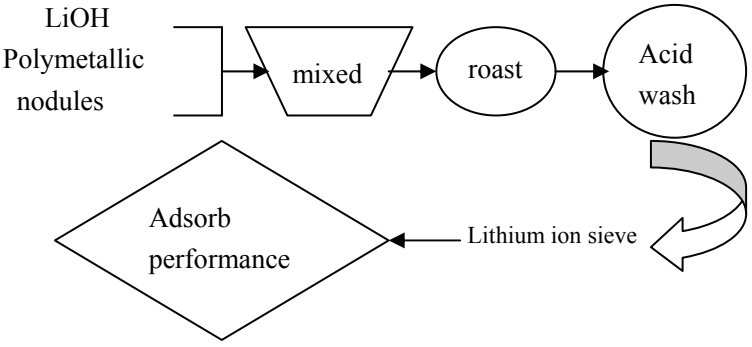

Fig .2 Flow chart of the synthesis of lithium adsorbent