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A NEW PROCESS FOR PRODUCING HIGH GRADE GRAPHITE FOR USE IN MANUFACTURING Mg-C BRICKS IN STEEL MAKING

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Based on the characteristics of graphite ore from Panzhihua district, the present research tried to find a new technology to increase the purity of the graphite carbon from 93% to 97%. Study was conducted on leaching agents, time, temperature, stirring speed and concentration of leaching solution affecting the process. The technological parameters chosen were: L / S=3:1, reaction time 30min, 5% concentration of sulfuric acid, reaction temperature 70℃, stirring speed 200rev/min. The results of the continuing tests with one kilogram showed that the graphite content can be increased from 93% to 97%, which reaches the requirement for high grade graphite. When waste acid from coke making is used to leach graphite, the result is also satisfactory, but the treatment of waste solution containing organic substances has to be further investigated.

KEY WORDS *graphite ore, high grade, chemical method*

1. Introduction

Graphite purification can be executed by means of chemical methods and high temperature. Chemical purification includes sodium hydroxide, hydrofluoric acid, and sodium carbonate, but sodium hydroxide is the most frequently used method, through which the purity of the final product can reach 97%–98%[1]. High temperature purification of graphite was conducted on the basis of its high sublimation temperature (4500℃) and low volatilization temperature of impurity to obtain 99.9% high pure graphite[2]. By heating graphite to 2500℃ under conditions of no air, the impurities with a low volatilization temperature were volatilized. Two recently published US patents[3] showed that after treatment the final product contained 98%–99% carbon from graphite originated containing 85%–89% carbon as a raw material. These treatments included alkaline dissolution/acid leaching under 0.5MPa pressure.

There are abundant graphite resources in Panzhihua district in Sichuan Province of China. By the

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process of beneficiation, graphite containing 93% carbon can be obtained. Graphite containing 93% carbon is used for manufacturing magnesium carbon bricks in steel mills. Some researchers have showed that the purer graphite is, the longer the life of magnesium carbon bricks. This study sought to find a new process for increasing the purity of graphite from 93% to 97%. This high pure graphite can improve the life of magnesium carbon bricks in the steel mill industry.

2. Experimental

The raw material (<75μm) for this study was taken from Panzhihua district in Sichuan Province of China. Chemical analysis of the sample is shown in Table 1. The leaching agent was 98% H_2SO_4, 36%–38% HCl, and waste acid containing 40% H_2SO_4 from the coke-making plant at the Panzhihua Iron and Steel Company.

Removal of impurity (α) is calculated as follows

$$\alpha = w_t / w_o \quad (1)$$

where w_t is a total of impurity quantity (g) when leaching reaction occurred for a period of time, and w_o is a total of impurity quantity (g) before leaching.

The flow sheet adopted in this experiment is published elsewhere[4]. A sample of graphite (50g) was weighed then put into a beaker and a leaching solution was added at differing L/S values. The leaching time was tracked once the leaching solution reached the pre-required temperature. Samples were taken, washed and dried for chemical analysis as the reaction proceeded over a period of time.

Table 1 Chemical composition (wt%) of Panzhihua graphite

C	Ash	V	H_2O	Ash				
				SiO_2	Al_2O_3	CaO	MgO	TFe
93.01	5.9	0.87	0.22	38.48	17.06	1.55	4.75	24.25

3. Results and Discussion

3.1 Small scale test

3.1.1 Effect of various leaching agents

Fig.1 demonstrates the effect of various leaching agents on the removal of impurities. When using hydrochloric acid chlorhydric acid as a leaching agent to treat graphite, the removal of impurities was higher than when sulfuric acid was used, but the difference was insignificant. The reason is that chlorhydric acid reacts with CaO to form soluble $CaCl_2$ and its content in the impurities is low. Sulfuric acid is inexpensive and its anticorrosion problems are easy to be solved, therefore sulfuric acid was used as a leaching agent for the present process.

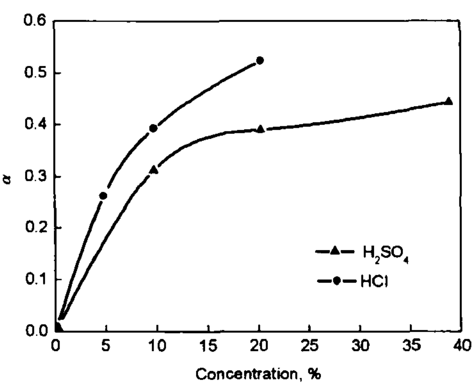

Fig.1 Effects of various leaching agent on the removal of impurities.

3.1.2 Effects of the liquid-to-solid ratio

Fig.2 indicates the effects of the liquid-to-solid ratios on the removal of impurities. With the increase of L/S, the removal of impurities increases, but the removal is insignificant when L/S is greater