

## Soda-lime Sintering Process for Aluminium Electrolytic Carbon Dross

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### Abstract



This paper discusses an experimental study of the sintering process of aluminium electrolytic carbon dross. In the first step, after flotation of carbon dross, a certain proportion of carbon dust is introduced into the sintering slurry, Then, in the rotary kiln sintering, the carbon burns and gives heat. At the same time, the alkali metal reacts with the fluorine and gives calcium fluoride, which enters the Leached washed sinter and is solidified in the subsequent process. The experimental results show that when 2 % of flotated carbon slag is added to raw materials in the sintering process, the fluoride content in flue gas during sintering process is 0.53 mg/Nm<sup>3</sup>, the leaching toxicity of fluorine in leached washed sinter after the sinter dissolution is less than 67.78 mg/L, and the dissolution rate of alumina and sodium oxide in the sinter does not decrease.

**Keywords:** Sintering process, Hazardous waste treatment, Aluminium electrolytic carbon dross, Harmless, Recycling.

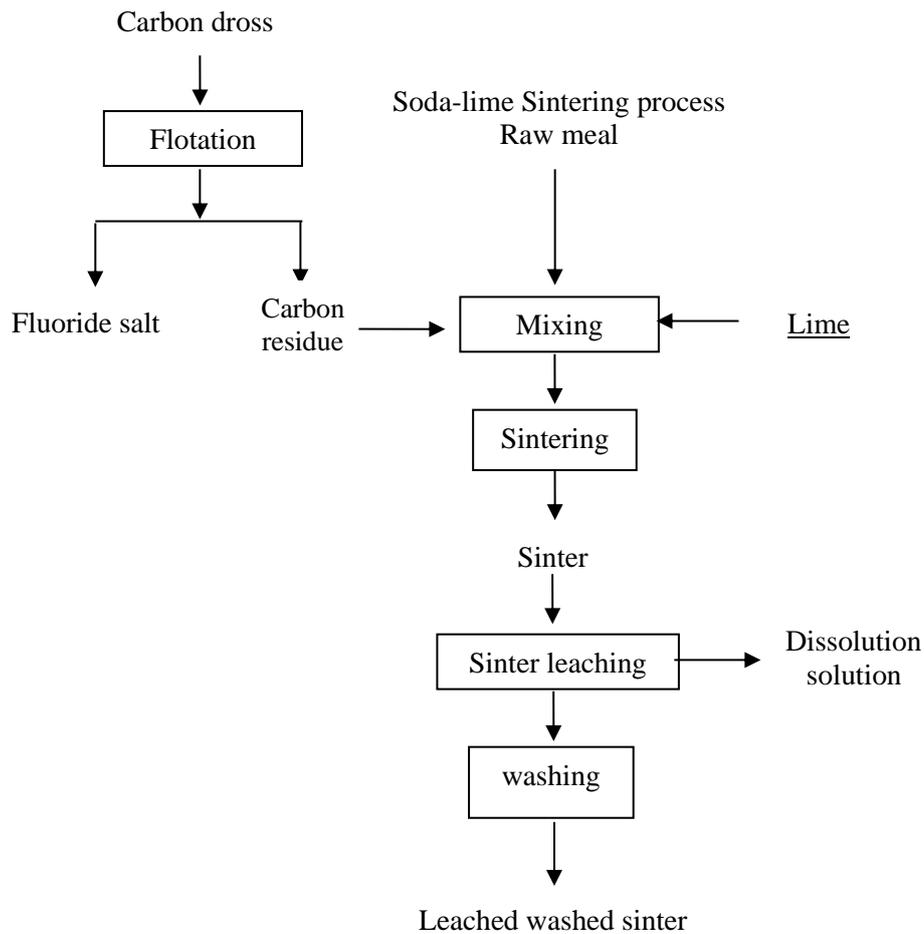
### 1. Introduction

Carbon dross is a solid waste produced by shedding anode surface and entering electrolyte during electrolytic aluminum production. On November 15, 2020, it was included in the National Hazardous Waste List (2021 edition) issued by the Ministry of Ecology and Environmental Protection of China.

The main components of carbon slag are electrolyte and carbon, in which carbon accounts for 20 - 42 %, electrolyte fluoride accounts for 58 - 80 %, carbon slag has the dangerous characteristics of leaching toxicity (fluoride), carbon sludge is the product of the flotation of carbon slag to remove fluoride salt, also has leaching toxicity.

If the valuable element sodium can be extracted from carbon mud and the combustion heat energy of carbon in it is sufficient, the hazardous waste can be reused, harmless and reduced. In recent years, Chalco Zhengzhou Non-ferrous Metal Research Institute has carried out the experimental study on the co-treatment of carbon sludge in the sintering process for alumina production by alkali and lime sintering and achieved satisfactory results.

Schematic diagram of experimental process is shown in Figure 1.



**Figure 1. Schematic diagram of experimental process.**

## 2. Physicochemical Properties of Carbon Slag and Carbon Sludge

### 2.1 Chemical Composition and Phase Composition

The chemical compositions of Carbon dross and Carbon residue are shown in Table 1.

**Table 1. Chemical composition of carbon slag (%)**

The sample	Al	O	Si	Mg	Na	K	Ca	Fe	C	S	F
Carbon dross	11.75	3.87	0.48	0.48	19.58	2.53	0.25	0.017	23.02	0.42	37.22
Carbon residue	3.97	5.46	0.68	0.27	7.62	0.53	1.02	0.14	60.81	1.50	17.26

## 5. Conclusion

It is feasible to treat electrolytic aluminium waste sludge by alkali - lime sintering Resource, harmless and reduction, to achieve emission standards and efficient recycling and utilization of valuable elements.

Adding a certain proportion of lime to carbon residue can make F in fluoride salt transform into  $\text{CaF}_2$  during sintering process, which has a good fluorine fixation effect.

Under the condition of adding 2% carbon residue to the raw material of the sintering process, both the flue gas discharged from the sintering process and the leached washed sinter discharged from the sinter dissolution meet the limit requirements of China's national standards, and more than 97% of the Na in the carbon residue can be recovered.