DOI: http://doi.org/10.21698/simi.2020.ab12

NEW SORBENTS FROM PYRITE ASH WASTE FOR H_2S REDUCTION FROM WASTE GASES

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Keywords*: H_2S, sorption, pyrite ash waste*

Introduction

High coal consumption leads to both environmental pollution and destruction of resources. Minimizing resource destruction and the environmental pollution is the main direction of our research.
The IGCC technology can increase the efficiency of coal use and in the same time reduces the intensity of pollution in the process of converting coal into electricity. Many researches has been done regarding the removal H_2S, CS_2, COS, mercaptan, thioethers, disulfide, thiophene from flue gases.
The paper is part of the current concerns regarding the prevention of air pollution with sulfur compounds, these being the most important pollutants of the atmosphere.
One of the main sources of air pollution with sulfur compounds is the burning of fuels, especially coal and petroleum fuels, in order to obtain energy.
The need for advanced desulfurization is required by the existence in the flue gases of sulfur compounds: H_2S, CS_2, COS, mercaptan, thioethers, disulfide, thiophene. Current guidelines regarding the pollution of the atmosphere with sulfur compounds concern the desulfurization of sulfur raw materials or intermediate gases when the predominant form of sulfur compounds is hydrogen sulfide.
Many researchers have used as sorbents metal oxides used as monocomponent materials or in mixture, multicomponent material. The most efficient oxides proved to be the oxide of Fe, Zn, Mn, as monocomponents or in mixture with oxides of Ti, Al, Si, aiming to obtain stable sorbents over time, with high retention capacity.
Since the amount of pyrite waste from the manufacture of H_2SO_4 is large, we tried to capitalize on this waste by trying to retain H_2S.

Materials and methods

The study consisted in the preparation of three sorbents for which it was used a characterized pyrite ash waste containing 80.51% Fe but also other ionic species such as Si (7.46%), Al (2.6%), Ca (0.57%) and an oxide was used. of zinc wurzit type. The preparation was semi-wet with different molar ratios of ZF combination (2:1; 1:1; 1:2), precalcination at 350^{o}C and calcination at 700^{o}C in order to obtain a mixed $ZnFe_2O_4$ oxide. The prepared sorbents were characterized structurally, texturally and morphologically in order to test them by saturation with H_2S

Results and conclusions

From the structural analyzes it was found that the different molar ratio of the combination of the two materials influences the percentage of zinc ferrite formation in the sorbent mass. Thus, in the ZF-3 sample (1: 2 molar ratio) it is found that the entire amount of ZnO reacted and contributed to the formation of zinc ferrite. The presence of other SiO_2, $CaSO_4$ or unreacted Fe or Zn oxides is also observed in the spectra (Figure 1).

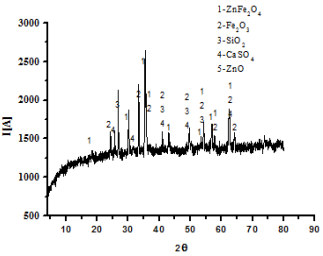

Figure 1. Spectrum XRD, sample ZF-3

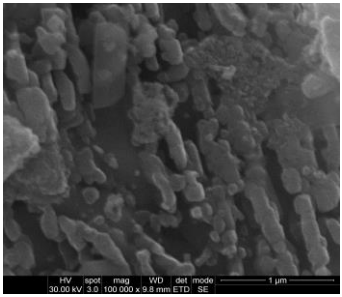

Figure 2. SEM image , sample ZF-3

Morphological analysis confirms the formation of zinc ferrite, but also the presence of these unreacted compounds deposited on ferrite crystallites.

From the SEM images made on the three samples, a mixture of crystallites of different sizes with cubic or elongated shapes is observed, in some sintered situations (Figure 2).

Textural analysis demonstrates that the presence of a larger amount of Fe in the mixture leads to an increase in the specific pore volume and the average pore diameter. The presence of Fe_2O_3 in the composition of the sorbent in quantities equal to or greater than the amount of zinc oxide, improves the textural characteristics of zinc ferrates. The characterized sorbents were saturated with H_2S and the retention capacity increased once the molar ratio of Fe_2O_3 in the samples increased.

In conclusion, the ZF-3 sample with a 1: 2 molar ratio forms the highest percentage of zinc ferrite that has the possibility of H_2S retention.