INTERNATIONAL SYMPOSIUM “THE ENVIRONMENT AND THE INDUSTRY”, SIMI 2020

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

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High coal consumption leads to both environmental pollution and destruction of resources.

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. Mar researches has been done regarding the removal H_2S, CS_2, COS, mercaptan, thioethers, disulfide, thiophene from flue gases. Many researchers have used as sorbents met 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 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 H_2SO_4 is large, we tried to capitalize on this waste by trying to retain H_2S.

Keywords: *sorption, pyrite ash waste, H_2S*

Table 1.The composition of pyrite ash waste

Element	Conc [%]	Element	Concentratie [%]	Element	Conc. [%]
Al	2,6	Mn	0,16	Fe	80,51
Si	7,4	Cr	0.11	Cu	0,17
S	3,56	Ca	0,57	Zn	1,13
Cl	2,2	K	0,28	Pb	1,3

Table 2 The type sorbent samples

Nr. sample	Code sample	Compozition	Molar raport	Observation
1	ZF-1	$ZnO:Fe_2O_3$	2:1	Dry105°C, 4h, precalcination 300°C -4h, calcination 700°C-4h
2	ZF-2		1:1	
3	ZF-3		1:2	

Zinc ferrite formation :

$$ZnO + Fe_2O_3 \rightarrow ZnFe_2O_4$$

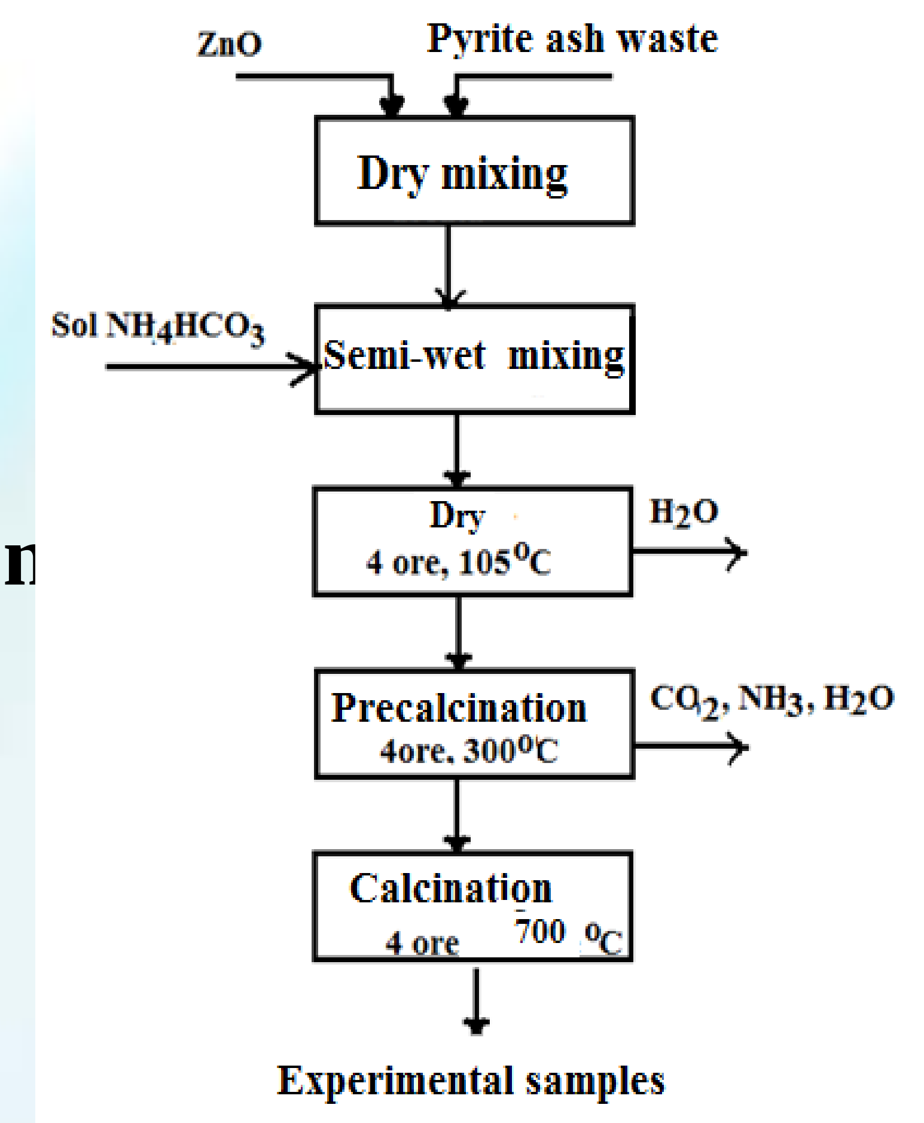
ZnO
Pyrite ash waste
Dry mixing
Sol NH_4HCO_3
Semi-wet mixing
Dry
4 ore, 105°C
H_2O
Precalcination
4ore, 300°C
CO_2, NH_3, H_2O
Calcination
4 ore 700 °C
Experimental samples

Fig 1 The scheme for obtaining desulfurization sorbents

Characterization of sorbents based on pyrite ash waste

The sorbents were subjected to the characterization from the point of view of:
- Composition-X-ray diffraction (XRD) analysis;
- Morphology-scanning electron microscopy (SEM and EDAX);
- Textures - BET analysis

Morphological characterization- Scanning electron microscopy

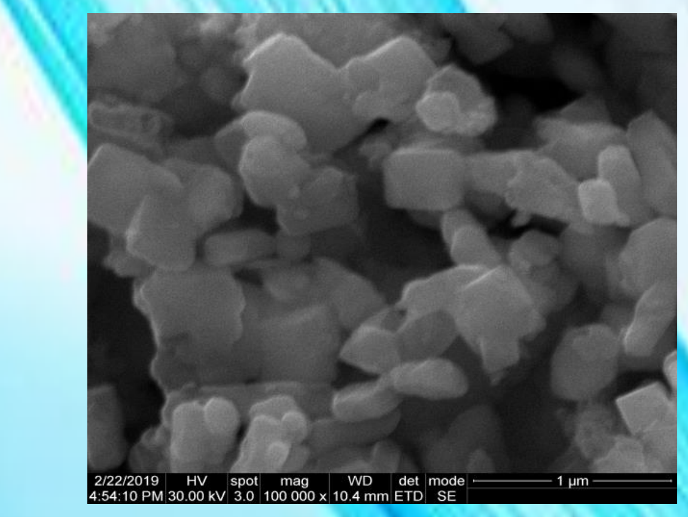
Fig. 5. The SEM image of sample ZF-1

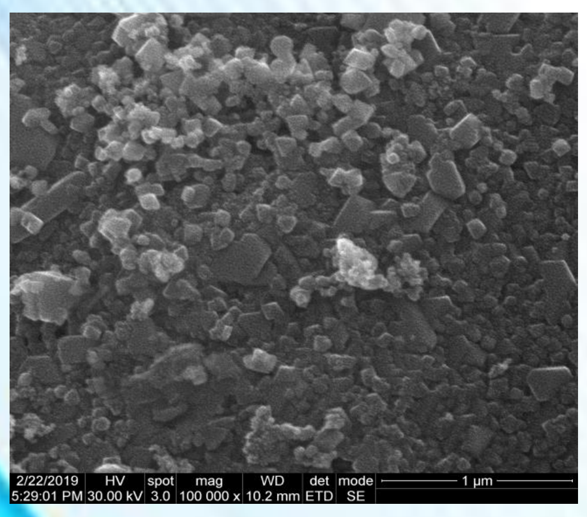
Fig.6 The SEM image of sample ZF-2

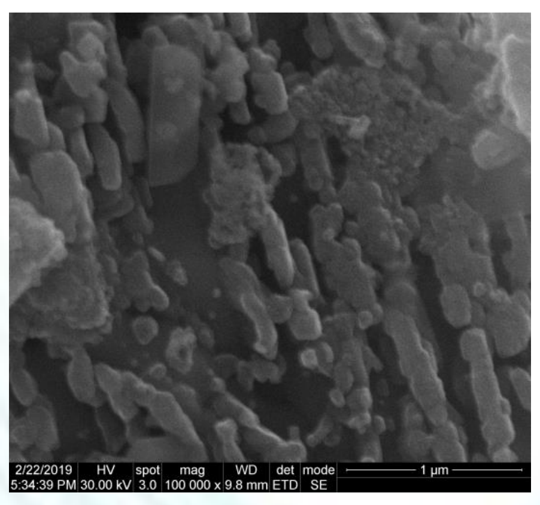
Fig.7 The SEM image of sample ZF-3

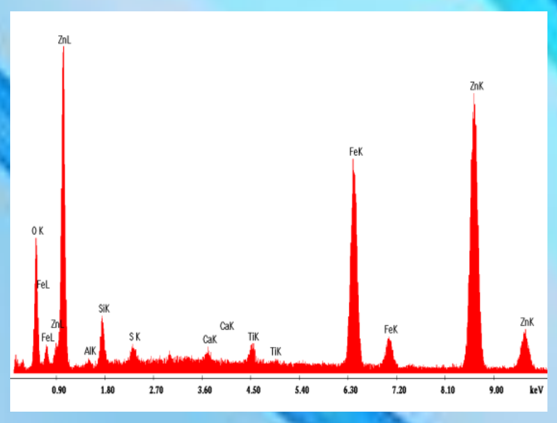
Fig 8 EDAX of sample ZF-1

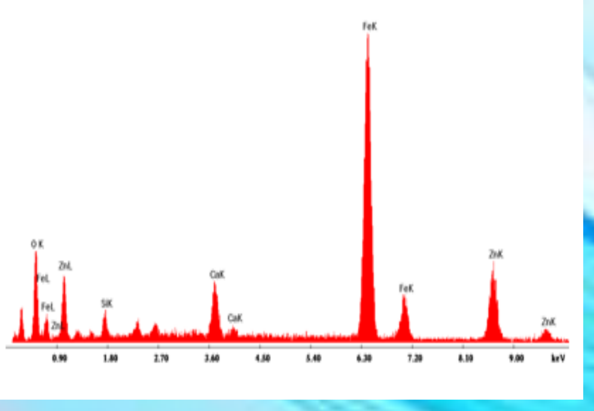
Fig 9 EDAX of sample ZF-2

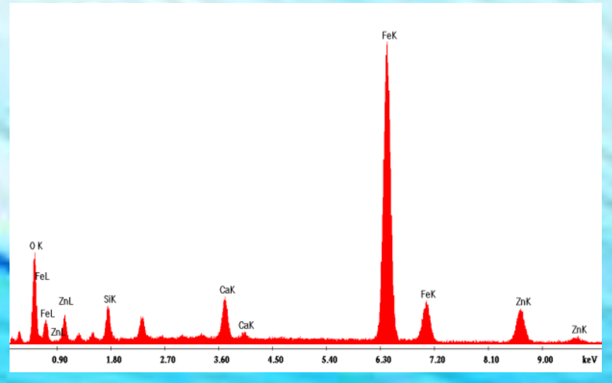
Fig 10 EDAX of sampleZF-3

Composition Characterization- X- ray diffraction (XRD)

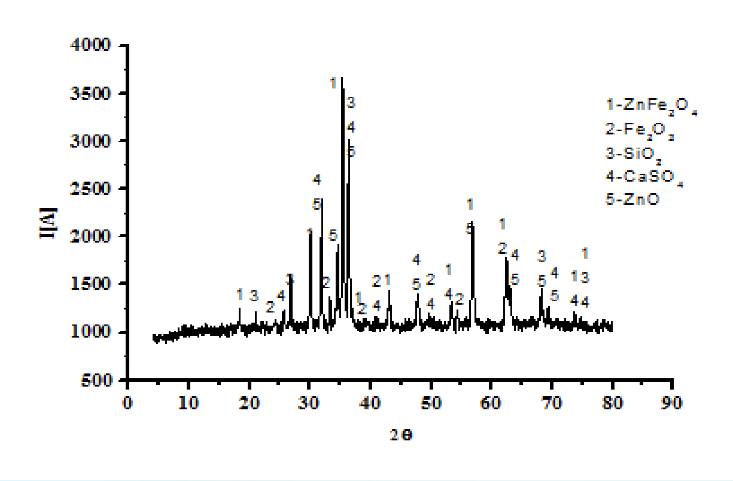

Fig. 2 The XRD spectrum, ZF-1

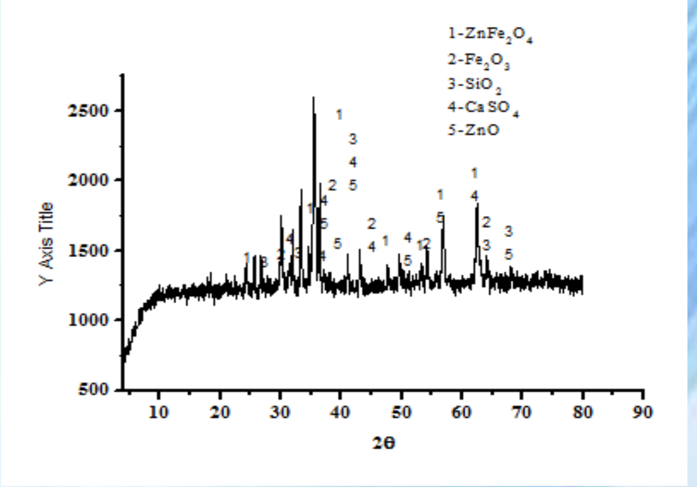

Fig.3 The XRD spectrum, ZF-2

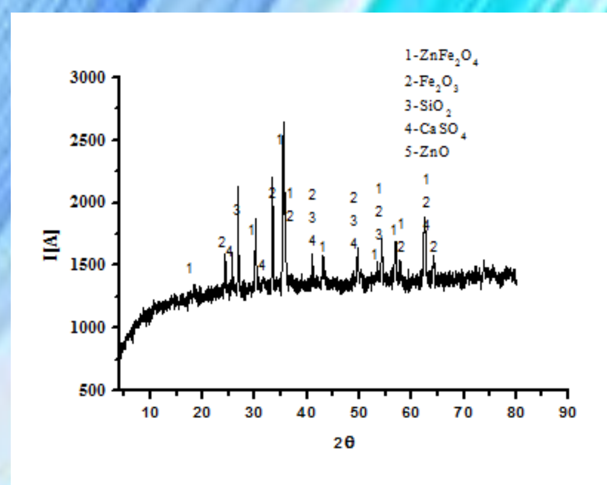

Fig. 4 The XRD spectrum, ZF-3

Textural Characterization

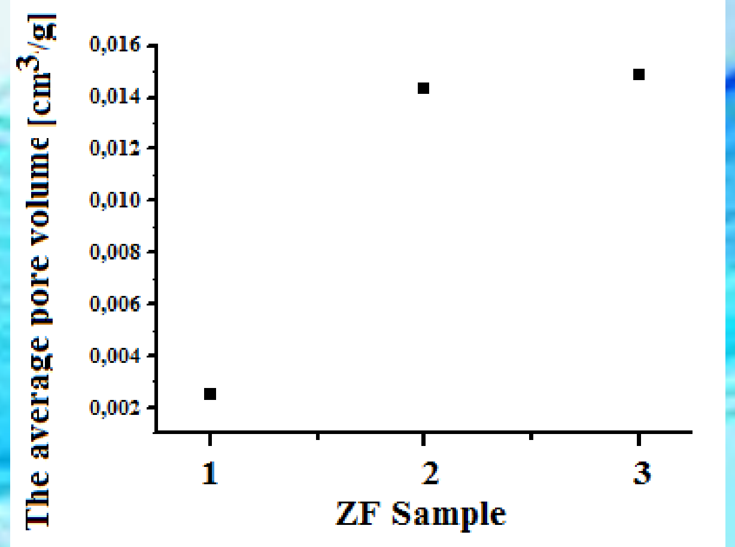

Fig. 11. The influence of the molar ratio by mixture on the specific pore volume of the sorbent

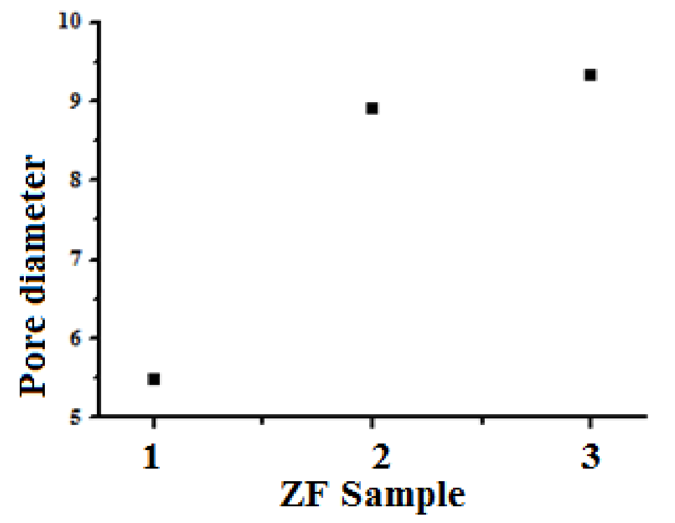

Fig. 12 The influence of the molar ratio of the mixture on the average diameter of the sorbent pores

Conclusion

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.

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.

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 diamete

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 zi ferrites. 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.