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DIFFERENTIAL THERMAL ANALYSIS OF THE ASHES OF SOME YUGOSLAV BROWN COALS

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ABSTRACT

All coal grades, regardless to their origin and geological age, contain :

- various organic matters - combustible part and
- variable quantities of mineral substances leaving behind ash after burning down.

Of special interest are electrofilter ashes originating from steam-power stations, heating plants and energy generating plants during the combustion of coal in fluidized state.

In the work are presented differential thermal and thermogravimetric testings of electrofilter ashes of some Yugoslav brown coals.

INTRODUCTION

All coal grades contain within its composition various organic matters - combustible part and the variable quantities of mineral substances leaving behind ash after burning down. The mineral substance of coal is of different quantity, composition and meltability.

The basic coal ash components are oxides, Si, Al, Fe, Ca, Mg, Ti, Na and K, and in addition the presence of 60 other elements was found out in the ashes of various coals.

In energy generating plants using coal as fuel great quantities of ash are formed.
The ash quantity in most cases ranges from 15-20% of the burnt coal quantity, depending on the characteristics of the coal itself.

It is estimated that in Yugoslavia about 6 million tons of electrofilter ash is formed annually, and regarding that we plan increased coal consumption, these quantities are going to be far higher in future. This presents a great problem from the economic and ecological points of view.

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In order to direct the electrofilter ash application in the best possible way, and to select the ash burning down regime, it is necessary to know the behaviour of ash at different temperature intervals. To monitor the ash thermic degradation process thermoanalytical methods are broadly used, and most freequently the differential thermal analysis (DTA), thermogravimetric analysis (TG), and the roasting microscope method to determine the ash melting point, are used.

EXPERIMENTAL PART

The ashes investigated in this work were formed by burning down the brown coals from one of the greatest coal basins in Yugoslavia Kreka-Banovići (Bosnia and Hercegovina). The coals used are from different mines of the mentioned basin, and the incineration in the thermoelectric-power station is performed in approximate ratio of 75% of lignite and 25% of brown coals.

The basin Kreka coals are typical representatives of lignite coals having 10-30% of ash, low thermal value (about 10460 KJ/kg) and lower sulphur content (up to 1%), while the basin Banovići coals belong to brown coals with lower ash amount (about 12%),higher thermal value (about 18800 KJ/kg) and slightly higher sulphur content (from 1-2.5%).

RESULTS AND DISCUSSION

Electrofilter ashes originating from burning down the mentioned coals were taken from different boilers and the individual electrofilter layers.

DTA of tested electrofilter ash samples was performed on derivatograph MOM-Budapest. The sample heating was done at the rate of 10°C/min. up to 1000°C, at the initial voltage of 100 V. The tested samples quantity was 700 mg, and as inert material was used γ-Al_2O_3. Derivatograms of tested samples are illustrated in Figs. 1,2,3,4,5 and 6.

Based upon the results obtained one can conclude that with the tested electrofilter ash samples some coal organic part remained which is manifested by the exothermic effects on derivatograms in the temperature ranges of 495-525°C which corresponds to the coal organic

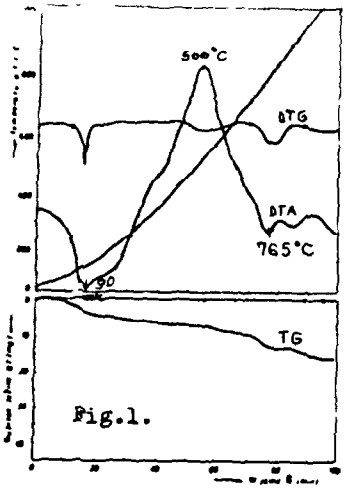

Fig.1.

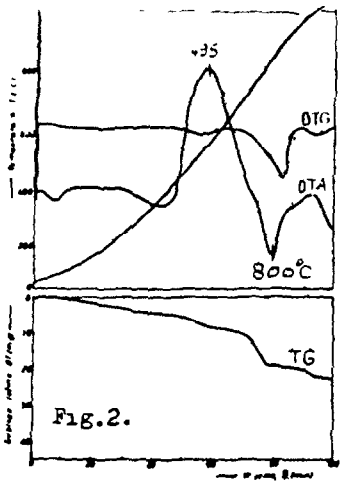

Fig.2.

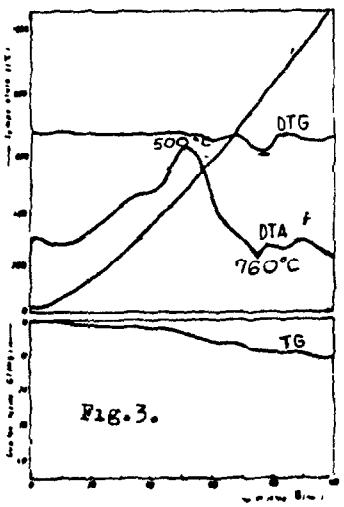

Fig.3.

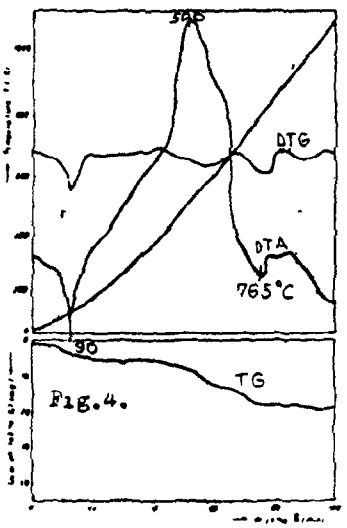

Fig.4.

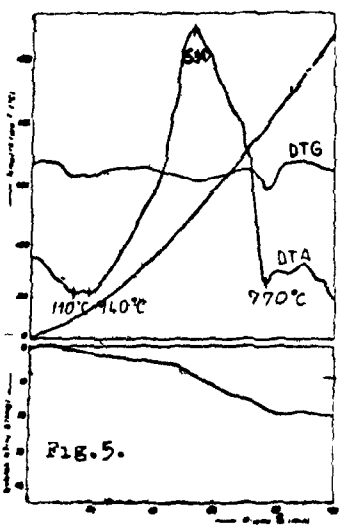

Fig.5.

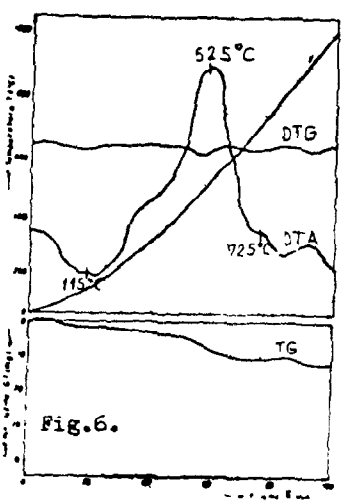

Fig.6.

matter degradation. Endothermic effects at the temperature of 725°C point to the presence of alumosilicates, and the effects of 700 up to 800°C to the presence of carbonate in the tested ash samples.

CONCLUSION

From the results obtained on derivatograms, exothermic and endothermic effects temperatures and weight losses, the difference of the tested samples (taken from the same boiler, but from different electrofilter layers) temperature characteristics is evident. This points to the fact that at different electrofilter layers the ashes of different temperature characteristics are obtained, indicating that when selecting the ashes for their purpose it is necessary to test the ashes from every electrofilter layer, especially as it is thus possible, in certain cases, to satisfy the set criteria for quality.

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