STUDY OF THE $CASO_4$ - NA_2SO_4 SYSTEM BY DIFFERENTIAL THERMAL ANALYSIS IN AIR AND UNDER SIMULATED FLUE GAS ATMOSPHERE

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The combustion of lignite containing high amounts of sulfur, calcium, and sodium induces the formation of sulfatic depositions (fouling) with the main components calcium and sodium. These depositions diminish the heat conductance and their spalling leads to damages in the power plant. The mechanisms for the formation of these conglomerations are widely unknown up to now. One can take into consideration that low-melting or adhesive sulfatic phases are able to initiate or will be the assignable cause of this fireside fouling.
The work was implemented with the assignment to study the quasi-binary system Na_2SO_4-$CaSO_4$ with Differential Thermal Analysis (DTA) and simultaneous Thermo Gravimetry (TG). X-ray Diffraction (XRD) measurements were done to verify the preparation of the binary compositions and Microstructure analysis was made by Scanning Electron Microscopy (SEM) and Energy Dispersed X-Ray (EDX), respectively.
Variant and even contradictory results and interpretations in the literature of the system Na_2SO_4 - $CaSO_4$ as well as for pure $CaSO_4$ could be clarified in this study with the main focus on the region of the transition temperatures to the melt containing phases. The melting point of $CaSO_4$ (Fp_{CaSO4}=1342°C) and the region beyond 80 Mol% $CaSO_4$ was measured the first time with DTA and TG in simulated flue gas atmosphere (14 Vol-% CO_2, 6 Vol-% O_2, 2 Vol-% SO_2, remain N_2) and in comparison to that under air. No difference in the melting behavior has been observed and there was no decomposition of $CaSO_4$ under these conditions.
Four samples of the composition xNa_2SO_4 - $(1-x)CaSO_4$ with x=18, 22, 78, and 82 Mol% were prepared and heat treated to prove the existence of a 1:4, 1:1, and 4:1 compound resulting in the confirmation of a Glauberite structure and the detection of the 3:1 structure at 850 °C.
As a result of these measurements it was possible to issue a phase diagram of the quasi-binary system of Na_2SO_4-$CaSO_4$.