Co-combustion of pulverized coal and solid recovered fuel in an entrained flow reactor- General combustion and ash behavior

Co-combustion of a bituminous coal and a solid recovered fuel (SRF) was carried out in an entrained flow reactor, and the influence of additives such as NaCl, PVC, ammonium sulphate, and kaolinite on co-combustion was investigated. The co-combustion experiments were carried out with SRF shares of 7.9 wt.%, 14.8 wt.% and 25 wt.%, respectively. The effect of additives was evaluated by maintaining the share of secondary fuel (mixture of SRF and additive) at 14.8 wt.%. The experimental results showed that the fuel burnout, NO and SO2 emission in co-combustion of coal and SRF were decreased with increasing share of SRF. The majority of the additives inhibited the burnout, except for NaCl which seemed to have a promoting effect. The impact of additives on NO emission was mostly insignificant, except for ammonium sulphate which greatly reduced the NO emission. For SO2 emission, it was found that all of the additives increased the S-retention in ash. Analysis of the bulk composition of fly ash from different experiments indicated that the majority of S and Cl in the fuels were released to gas phase during combustion, whereas the K and Na in the fuels were mainly retained in ash. When co-firing coal and SRF, approximately 99 wt.% of the K and Na in fly ash was present in water insoluble form such as aluminosilicates or silicates. The addition of NaCl, PVC, and ammonium sulphate generally promoted the vaporization of Na and K, resulting in an increased formation of water soluble alkalis such as alkali chlorides or sulphates. The vaporization degree of Na and K was found to be correlated during the experiments, suggesting an interaction between the vaporization of Na and K during pulverized fuel combustion. By collecting deposits on an air-cooled probe during the experiments, it was found that the ash deposition propensity in co-combustion was decreased with increasing share of SRF. The addition of NaCl and PVC significantly increased the ash deposition propensity, whereas the addition of ammonium sulphate or kaolinite showed a slight reducing effect. The chlorine content in the deposits generally implied a low corrosion potential during co-combustion of coal and SRF, except for the experiments with NaCl or PVC addition.

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