Characterization and leaching behavior of Fly Ashes from Power Plants in Yanzhou Mining District

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Method and Experiments

Mineralogy of the fly ashes were determined by X-ray diffraction. K, Na, Ca, Mg, Cu, Pb and Zn in ashes were determined by ICP-MS and spectrophotometer for As. 15 g fly ash samples (FA1) was placed in 1 L polyethylene bottles and mixed with 1 L of distilled water (pH=7). The bottles were shaken for 24 hours in a horizontal shaker at room temperature. Then, the supernatants were decanted and filtered through a 0.25 um micropore membrane filter at the end of the leaching experiment, and the final pH in leaching solution was measured . The process of the same samples was repeated three times. The higher ratio between the ash and water was to prevent the solution achieving saturation and allowing all the water-soluble fractions in the ashes to be dissolved out.

Discussion of results

According to chemical composition, the ashes from the study power plants belong to CaO-Fe_2O_3-Al_2O_3-SiO_2 system. The chemical composition usually fluctuates much due to the different mineral components contained in the coals. The analysis result showed that the content of the main minerals in coal is positive to the chemical and mineral composition of ashes. The trace elements are preferentially concentrated in fly ash, because of its small particles size and large specific surface. So much of K, Na, Ca, Mg and the partial of Pb, Zn, Cu, As, which are adsorbed on the surface of fly ash, are high in concentrations. Therefore, in the ashes of small particle size, the contents of trace elements are high.The leaching test results are shown in Table 3 .From the Table 3, Ca and Na concentrations in the initial leachate are high. Cu, Pb, Zn concentrations were lower than the concentrations of Na, Ca, K and Mg. Zn Shows similar trend to that of Cu, but maintains a constant level. As were generally close to detection limit, but still detectable in all leaching solutions. Such continuous release of Cu, Zn, Pb and As might signify dissolution of the glass in the ash particle.

Conclusions

The major composition of ashes are SiO_2, and Al_2O_3, low amounts of Fe_2O_3 and CaO, and little content of SO_3, P_2O_5, Na_2O, K_2O and TiO_2.

The leaching behavior of fly ashes indication that the trace elements in the fly ash particles are mainly associated with the surface but some of them are incorporated with the glass matrix as well.

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The influence of fluid components H_2O and CO_2 on the partial melting of upper mantle peridotite

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The importance of fluid components (especially H_2O and CO_2) in the partial melting of upper mantle peridotite is manifested by the explosive nature of the volcanism and much other indirect evidence. The role these fluid components play, however, remains as elusive as the fluid itself. Intensive discussion in the 1960s and 1970s ended inconclusively. Recent experimental studies also showed a marked lack of mutual consistency. This situation has mainly been caused by the lack of a suitable analysing technique and the lack of full evaluation of experimental techniques. In this study piston-cylinder experiments with long run durations are performed in the system CaO-MgO-Al_2O_3-$SiO_2$$\pm$$H_2O$ at 11 kbar from H_2O-free condition to H_2O-saturation. Composition data are collected by electron microprobe and FTIR (for H_2O and CO_2 in melt), producing the first complete set of composition data for partial melts multiply saturated with the Sp-lherzolite phase assemblage. We find that in these nominally C-free experiments, the melts inevitably contain non-negligible amounts of CO_2, up to ~ 0.7 wt%, which come from the hydroxides used to add H_2O or from graphite diffusion through the Pt capsule.

Our data clearly show that H_2O not only strongly affects the partial melting temperature but also the melt composition. It is found that 1 wt% H_2O in the melt decreases the solidus by ~ 40 degrees. The melt composition gradually changes from olivine basalt at H_2O-free condition to tholeiite at H_2O-rich condition. The melt also decreases its diopside component and eventually becomes corundum-normative. These data link together the previous results at H_2O-free condition (Presnall et al., 1979; Liu and O'Neill, in press) with those at H_2O-saturation (Kushiro, 1972).

In agreement with Eggler (1978), the effect of CO_2 on the partial melting temperature is essentially negligible. Its effect on the melt composition, however, is quite strong, stronger than but generally opposite to that of identical H_2O. Since CO_2 has always been detected here and in those fully analysed experiments in Gaetani and Grove (1998; up to ~ 1.3 wt%), its variation in abundance might explain some key discrepancies in previous hydrous partial melting studies.

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