

Speciation of Trace Elements in IGCC Fly Ash

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The modes of occurrence of trace elements of interest (Ni, V, Ga and Ge) in fly ash arising from an Integrated Gasification in Combined Cycle (IGCC) power plant are investigated in this study. Different research tools, such as conventional mineral and chemical analysis, leaching tests, wet sequential extraction, SEM-EDX, Mössbauer spectroscopy and XAFS are combined to obtain information on the speciation of these elements. The XAFS data are believed to be the first obtained on a fly-ash from an IGCC system. The results of this study show a clear differences between the mode of occurrence of the above elements in this material and those reported for fly ash from pulverized coal conventional combustion. Ge occurs mainly as water soluble species, GeS and/or GeS₂ and hexagonal GeO₂. Ga is present as an oxide, probably substituting Al in aluminosilicate glass. Nickel is associated with As and occurs mainly as nickeline (NiAs) with minor proportions of Ni arsenates. Vanadium occurs mainly as V₂O₃ (III) with minor amounts of VO₂ (IV) in the aluminium-silicate glass matrix. Sb is bound to reducing phases, sulphides and arsenides. Pyrrhotite and wurzite-sphalerite are the main species containing Fe and Zn, respectively, but an important fraction of iron is also present in the aluminium silicate glass. We would like to thank the European Coal and Steel Community (ECSC) and the Spanish Ministry of Science and Technology for supporting this study (ECSC 7220-PR145, REN2001-1728).