European Mineralogical Conference
Vol. 1, EMC2012-136-1, 2012
European Mineralogical Conference 2012

Mineralogical Changes expected in Clay and Mudstones adjacent to a Coal Seam destined for Underground Coal Combustion

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Underground coal combustion (UCC) for syngas generation has been reported from China, Russia and Australia, amongst others. Research has been focused on coal characteristics, tectonic and hydrogeological aspects to ensure adequate sealing of the respective coal deposit and modeling of the combustion process. Scarce information exists on the mineralogical transformations occurring in the hanging wall, footwall or Tonstein during combustion. Analogs for mineral transformations and textures can be found in contact metamorphism of pelitic rocks and the production of structural or sanitary ceramics. The Mulpún coal basin, Los Lagos Region, Chile, is the first in that country where in situ combustion of a test panel will be carried out. Coals are of subbituminous grade and maceral composition points to good combustion comportment. Samples from the underlying and hanging wall clay and mudstone sequences of the coal seam have been analyzed by X-ray diffraction at ambient temperature and after a heating cycle equivalent to that applied to non-white burning ceramics. Scanning electron microscopy has been carried out on starting materials and formation of porosity in the heating process has been registered by Qemscan. Additional data include content of organic matter by low temperature ashing, differential thermal and gravimetric analyses and whole rock major element analyses. Mineralogy of clay and mudstones is dominated by kaolinite, quartz, illite-muscovite, siderite in some samples and minor K-feldspar and chlorite. The <2μm fraction confirms the whole rock clay phases, but in addition reveals the presence of corrensite and and R1 ordered illite/smectite. Heating results in the formation of mullite, minor sillimanite and conservation of quartz and feldspar with vitrification along the rims. The abundance of hematite depends on the presence of siderite in the starting rock. The formation of cristobalite is considered to depend on the presence of smectite and illite-muscovite in the starting material. The presence of flake-like distributed organic matter enhances the formation of devolatilization vacuols parallel to the original bedding in the heated samples. Even distribution of organic matter can lead to coke-like bloated textures.