Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03679, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03679
EGU General Assembly 2008

Numerical Modelling of Underground Coalfire Fighting by Saltwater in the Wuda Coal Mining Area

J. Han, M. W. Wuttke, M. Halisch, W. Kessels
(Jing.Han@gga-hannover.de / Phone: +49 511 643 3513)

Spontaneous combustion of natural coal deposits causes an immense waste of resources and increase of environmental pollution in the atmosphere and in the ground- and surface water. This problem occurs all over the world where coal is produced, processed or stored. In the big arid coal mining area of northwest PR China the necessity for protecting the economically valuable coal resources and the environment is recognized leading to increased fire fighting activities, mostly by removing the burning coal, sealing the surface from oxygen and cooling the firezones with water. Within the Sino German Project “Innovative Technologies for Exploration, Extinction and Monitoring of Coal Fires in North China” to save fresh water we propose to use salt water, which is available in the selected coalfire zone in Wuda, Inner Mongolia.

When injecting salt water into high temperature zones of burning coal, the water will evaporate and the salt will crystallize. Besides the cooling effect of the evaporating water the pores of the permeable rocks will be partially closed by salt crystals. The resulting lower permeability will prevent a further oxygen transport to the combustion centre. In addition saltwater injection will increase the thermal conductivity of the mostly fractured rock and coal near the combustion centre by increasing the thermally conducting areas between the mineral grains. Saltwater will also be used for rewetting an oxygen isolating sand cover.

To prove these predicted effects we first perform small scale experiments, simulating the burning coal with an artificial heater. Both salt- and freshwater will be used for injection. The experimental data will be used to analyze the effects of the salt water injection on the reactive transport system around the coalfire centre.

An already successfully applied numerical model, based on the FEM code Rockflow (LUH), will be adapted and extended to understand the underground coalfire extinction now including multiphase transport and phase transition processes. This model will consist of instationary mass, momentum and energy conservation equations for each phase (coal, oxygen, exhaust gas, water, steam, salt water, solid salt) coupled by source and sink terms describing the exchanges of mass and energy between the phases. Several scenarios according to the coal centre temperature, covering area, amount of injected water etc. will be set up and compared to yield a comprehensive understanding of the fire fighting process.

Key words: coalfire; fire fighting, saltwater; multiphase transport; phase transition, numerical modelling