



Coal Fire Fighting: Removal of Thermal Energy by Heat Pipes

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Fires are mainly controlled by the availability of three parameters: fuel, oxygen and thermal energy (heat). Hence, all extinction methods are related to the reduction of one or more of these parameters. The extensive removal of one of these parameters will stop a fire.

The ability of so called heat pipes to remove thermal energy from the underground coal fire was tested by laboratory and field experiments. A heat pipe is a device of very high thermal conductance. By using a heat pipe, considerable quantities of heat can be transported from the underground to the surface. The heat pipe is filled with a working fluid selected for the present temperature range. Heat is applied and conducted from the coal fire to the evaporator part of the heat pipe and causes the liquid to vaporize. The vapor moves to the condenser section above the surface. The vaporized fluid is condensed and the condensate flows back to the evaporator section by gravity force. The energy removed from the fire is rapidly transferred to the condenser section when the fluid condenses there. From there the energy will finally flow to the surrounding air and extended cooling areas (paddles) may facilitate this transfer. Once installed, the process will run continuously.

Within the Sino-German coal fire research initiative “Innovative technologies for exploration, extinction and monitoring of coal fires in North China” prototypes of heat pipes were tested in laboratory scale as well as in the coal fire area in Wuda, China. As the result of the investigations it will become possible to determine the amount of removed heat to define the needed number of installations. The effect of installed heat pipes on the coal fire propagation will be estimated by means of numerical simulations.