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# ACARP MATTERS

## HIGH EXPANSION FOAM REDUCES THE RISK OF GOAF HEATINGS

**New foam injection technologies have proven successful in reducing airflow in longwall goafs, thereby enhancing the effects of low-flow inertisation techniques and helping mine operators manage self-heatings underground.**

Researchers from CSIRO Earth Science and Resource Engineering undertook a project to develop and demonstrate cost-effective foam technology applications with existing industry inertisation practices. The aim of this work was to reduce the risk of heatings in longwall panels during slow retreat periods and the final stages of panel extraction while bolting up operations are carried out. Researchers identified products suitable for foam plugs, carried out extensive computational fluid dynamics (CFD) modelling studies to simulate airflow in the goaf, and conducted tracer gas tests to evaluate the effectiveness of the plugs. The nitrogen or compressed air-based foam being tested expands between 30 and 50 times its size and has a consistency similar to shaving cream.

Project Leader Ting Ren said the main coal producing countries around the world had been using high expansion foam to control spontaneous combustion for some time.

"Cutting off oxygen supply to coals left in the goaf is critical to reducing the occurrence of goaf heatings," he said.

"The use of foam 'plugs' introduces a temporary seal and increased resistance, thereby reducing the momentum of air flow into or out of the goaf along the goaf ribside. Permeability can be high in these areas due to the collapse of the chair pillars and abandoned supports. In this situation, the use of the foam plugs will reduce the airflow ingress into the goaf and limit the chance of deep heatings which are hard to detect and control.

"The main advantages of foam are its ease of use, low cost, and the simplicity of the associated system compared with pumping inert gases which often requires complicated systems and is, therefore, more expensive. Foam injection can be conducted on the surface via pipes or boreholes, or underground close to the desired injection points."

Laboratory tests were conducted to identify the constituents and the additives needed to produce consistent and long lasting foam. Surface foam production trials were also conducted to determine the effect of various foaming agents and the impact of surrounding atmosphere and air velocity on the stability of the foam. Although the durability and stability of the foam depends on the surrounding wind airflow and confinement conditions, the tests indicated that the new chemical blend for foaming could last for many days.

The CFD modelling results demonstrated that when goaf inertisation is used in combination with goaf foaming, the effectiveness of the inert gas can be significantly increased. It also showed that optimum inertisation could be achieved when inert gas is injected between two foam air plugs along the perimeter of the goaf area.

Industry Monitor Tim Harvey said previous inertisation research had concentrated on the development of inert gas generators.

"The focus of this research was to make foam injection technologies simple and cost-effective so that we can increase the safety and productivity of Australian underground mines. The results will help the industry develop strategies to reduce self-heating incidents when operating longwalls in difficult geo-mining conditions," he said.

Further laboratory work and field testings are required for proving the delivery system and foam performance.

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