Development high expansion foam to construct quick setting stopping in case of fire in underground coal mines

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For the past few decades, the chemical and physical properties of foam have become important topic in the inter-disciplinary field of research and development. The application area is being limited to extinguishing of fire in mines also but cannot serve the purpose of redemption of early fire in mines [1,2]. Hence there is a need of design and synthesis of new materials for stopping in mining industries. A high expansion foam named as Blockage 52 is developed which is the combination of three resins mixed at different proportions at room temperature.

Objectives

1. Development of materials that enhances the speed of construction of barrier to stop and restrict air circulation near the site of fire.
2. The barrier formed should be light weight and be able to withstand the load of underlying strata.
3. The stopping should serve as fire resistant and leakage proof of air.
4. It should be non-toxic in nature.
5. It should be ease to transport to work site with minimal man power.

Properties of chemicals and preparation work

The principle of foam generation works on exothermic reaction. Two chemicals are mixed together in a ratio of 100:110 parts by weight to get the desired product (Table 1). One of the chemical acts as an accelerator and a catalyst to the base; making the base expand by increasing the size of the molecules within the chemical. The other chemical acts as a base material. These two chemicals would swell and convert into hard foam within a short duration of time. Some catalysts like hydrate and amine based are added to activate the expansion. This mixture enables expansion of foam to 20 times by volume within 30 seconds. The flexibility and toughness of final foam product is done by

addition of plasticizers like chlorinated liquid paraffin. This final product form is non-combustible, non-toxic and fire-resistant expandable foam which can get a concrete like character within 5 minutes. Basing on characteristic of foam attempt was taken to use below ground to construct the air and water leakage proof stopping near the prone to fire susceptible areas (Figure 1).

Table 1: Chemicals for foam formation

	Chemical A	Chemical B
Nature	Accelerator	Base
Sp. Gr.	1.20 - 1.24	1.20 – 1.30
Colour	Brown/Dark Brown	Colourless/Slightly Yellow

Figure 1: Formation of foam stopping along with mats

Results

It was observed that the stopping was prepared by two shifts operations which in the traditional present method take around 20-22 days. Cost wise it is at par with the present cost of construction. So the burning of coal due to fire by 20 days can be saved.

References

1. A. Ozmet, and J. B. Walsh, U. S. Foam Technologies Inc. Longview, Texas (2010), 251.
2. R. H. Grau, A. Mazzella and A. L. Martikainen: Jr Mine Vent Soc South Africa (2012), 65(3), 16.