

# Development of fire-extinguishing powder compositions for automatic means of explosion containment

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Automatic means of localizing explosions are used in mines which are dangerous due to the formation of an explosive concentration of methane and the presence of suspended coal dust. Their effectiveness directly depends on the rate of creation of a flame-extinguishing barrier from particles of fire-extinguishing powder (FEP), which overlaps the cross section of the mine. Explosion containment systems are able to suppress the source of ignition at the initial stage during deflagration, when the propagation of the flame front passes at subsonic combustion rates.

Elimination of flame leakages outside the flame-extinguishing powder damper can be realized only with the help of rapid ejection of the FEP towards the flame front movement through the spray nozzle system.

In order to reduce the ejection time and, thus, reduce the time for creating a localizing barrier, the FEP was developed with decreased interaction forces between the particles of the powder composition and with a lower energy value required to start the flow process.

During the study, it was found that the manufacture of FEP with a lower flow energy value is possible due to the use of modified silicon dioxide with spherical monodispersed particles ~ a size of 55 nm. This composition has high flowability (specific flow energy 8.04 mJ/g, cohesion 0.340 kPa), superhydrophobicity (apparent contact angle 168°) and low moisture absorption. By means of the proposed one-step synthesis method for superhydrophobic silicon dioxide manufacture, surface properties were achieved without additional post-synthetic modification. It makes synthesized particles are promising functional filler for FEP designed for automatic means of localizing explosions.

Field tests of the developed FEP demonstrated the prospects of these researches.

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