A FAST TEMPERATURE SENSOR FOR EXPLOSIVE ENVIRONMENTS

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The paper describes design and test of an optical temperature sensor which addresses the existing need for reliable fast temperature measurements in harsh environments. Its operation rests on the existence of absorptive gases being in thermal equilibrium and emitting nearly black radiation. These conditions can be assumed to be fulfilled with sufficient accuracy in the area occupied by detonation products, as highly pressurized absorptive gases predominate in a detonation cloud.

The sensor is based on the emission-absorption method and allows for detecting temperatures in a 10 microsecond time scale. The principal range of detectable temperatures is dependent on detection wavelength and electric circuit, only. Practically, the range is limited by component robustness and duration of the high temperature phase, which is assumed to be limited.

The working principles of the sensor as well as its scope of use are derived from simple thermal emission theory, and shown to be in good agreement with tests. Results from experiments with a first prototype, performed in detonation environments, are analyzed. Different options for adapting the sensor to special environments are outlined.