

Safety characteristics of hybrid mixtures for explosion protection

Determination methods capable for standardization (NEX-HYS)

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In this joint project, standardized measurement methods for hybrid mixtures are developed, which serve to determine safety characteristics for explosion protection. A hybrid mixture is a multi-phase system consisting of fuel gas or vapor, as well as air and combustible dust. The results will be published in a final report and as a pre-standard of the German Institute for Standardization (DIN). This pre-standard enables test institutes and industry to assess explosion hazards when operating technical plants with hybrid mixtures and thus to control processes both more safely and more efficiently. Standardization at the international level is supposed to be initiated based on this pre-standard. The project is funded by the Federal Ministry of Economy as part of the WIPANO frame program, which promotes knowledge and technology transfer through patents and standards.

For flammable gases, vapors and dusts, there are already standards that define procedures for determining the relevant characteristics. This ensures the comparability of measured values between different laboratories. However, these standards treat gaseous and solid flammable substances separately due to their different explosion properties. For example, the design of the ignition vessels, the ignition sources and the test procedure for fuel gases and dusts differ considerably. For hybrid mixtures, however, the safety parameters cannot be determined according to the existing standards. It is known from previous research that some of these mixtures are more sensitive to ignition, have wider explosion ranges and that the effects of explosions can be more severe. For this reason, it is not sufficient to rely on the safety-related characteristic parameters of the individual components for the purposes of a hazard assessment. Determination methods are now to be developed and brought to standardization maturity for the following characteristic parameters of hybrid mixtures: lower explosion limit, limiting oxygen concentration, maximum explosion pressure, maximum rate of pressure rise and ignition temperature. On the one hand, the influence of different ignition sources on the determination of the individual parameters is tested. On the other hand, the mixture formation in the test apparatuses is investigated and a procedure for further tests is determined. This is followed by comparative tests on laboratory scale (20 L-sphere) and on pilot scale (1 m³ vessel) with special consideration of the measurement uncertainty.