Development of Performance-Based Protection Standards from Recent FMRC Research on the Hazards of Silane Releases

Franco Tamanini
Research Division
Factory Mutual Research Corporation
1151 Boston-Providence Turnpike
Norwood, Massachusetts 02062

ABSTRACT

Factory Mutual Research Corporation (FMRC) is a research and engineering support organization charged with providing advanced property loss prevention guidelines for use by the three mutual insurance companies of the Factory Mutual System. This goal is achieved through a combination of internally-sponsored activities and contract work for industrial or government clients. Targeted research is undertaken when available knowledge is found to be inadequate to satisfactorily address the situation for which protection needs to be devised. This was perceived to be the case of hazards from accidental silane leaks encountered in semiconductor manufacturing and other industries. In particular, existing design recommendations for the protection of ventilated enclosures were found to prescribe ventilation requirements based on outdated and, in some instances, misinterpreted data. Extensive research was carried out by FMRC (under partial support from SEMATECH) to develop improved protection guidelines for silane handling systems through enhanced understanding of the behavior of releases of this pyrophoric gas. The work has addressed and generated new information on three aspects of the problem: the prompt ignition behavior of silane; the reactivity characteristics of quiescent silane/air mixtures; and the rates of reaction of silane leaked into enclosures with and without explosion venting, in the presence of ventilation air flow. After developing correlations and generalizations of the test data with the assistance of models, this new knowledge was used as the foundation for a new set of performance-based protection guidelines for implementation by Factory Mutual loss prevention consultants worldwide. Because of their departure from rigid prescriptions, these guidelines provide the designer with the ability to evaluate different protection solutions and select the one that is most appropriate for the particular situation of interest.