**Plenary lecture**

**Explosions in the Process Industry: state of the art and future research**

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***Abstract***

The term explosion corresponds, in its broader sense, to any rapid heat release or pressure rise which is able to produce damage. Even restricting to the process industry, this definition applies to a number of physical and chemical phenomena. A classical and useful outline, commonly adopted in industrial contexts, is based on the accidental scenarios: i) gas, vapour and dust explosion in confined, partially confined and unconfined systems, for combustion-related scenarios; ii) boiling-liquid expanding vapour explosion and rapid phase transitions, for the case of super-heated liquids; iii) condensed-phase or point-source explosion, for the case of (solid and liquid) pyrotechnic, propellant and explosive substances; iv) confined explosion due to internal compression induced by external heating of for the occurrence of runaway reaction with the production of heat and gas.

All these phenomena are associated with the production of heat (fire), fragments, or shock wave, and may produce damage on people, equipment, and environment, either directly or un-directly (domino effects). This paper gives the state-of-the art and the future research needs for the cited industrial explosions, with the specific aims of the design of prevention (pro-active), protection and mitigation system.