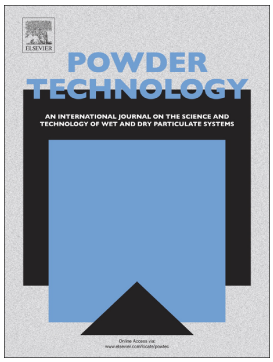


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# Investigation of the pyrophoric tendency of the powder of corrosion products in an oil tank

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## ABSTRACT

The pyrophoric tendency of the powder of corrosion products and deposits in oil tanks was investigated by performing several series of tests in a modified self-heating experimental apparatus based on the crossing point temperature method. Three samples of the powder of corrosion products and deposits in oil tanks as well as a ferrous sulfide were used as test samples. The corresponding apparent activation energies ($E_a$s) were obtained: 26.1 kJ·mol$^{-1}$ for the corrosion products of a crude oil storage tank, 27.2 kJ·mol$^{-1}$ for the middle distillate oil storage tanks, and 43.5 kJ·mol$^{-1}$ for ferrous sulfide; the unexposed cross-point for deposits of a crude oil storage tank was at a temperature below 250°C. Those values of $E_a$s indicated that the corrosion products of the two oil storage tanks showed a stronger pyrophoric tendency than did the deposits of the crude oil storage tanks and ferrous sulfide. Furthermore, the $E_a$ values were similar to those of reactions reported for the incomplete oxidation of hydrogen sulfide ($H_2S$), thus supporting the viewpoint that $H_2S$ may be considered the intermediate product for accelerating the self-heating and self-ignition of sulfide at temperatures below 250°C and may play a major role in inducing fires and explosions in storage oil tanks. In addition, possible sources of $H_2S$ in self-heating of the corrosion product were largely caused by thermochemical sulfate reduction or thermal decomposition of the organic matter of oil tanks.

***Keywords:*** Pyrophoric tendency, Corrosion product, Crossing point temperature method, Apparent activation energy, Oil tank

## 1. Introduction

An oil tank is a piece of storage equipment that is typically used as a container for different volumes of crude oil and petroleum products that are generated in petrochemical and chemical plants. A typical tank at oil refineries and fuel storage depots is composed of a standing vertical cylindrical shape with a fixed or floating hemispherical roof that is fitted with an access hole or vent, along with an appropriately large manhole and a small gauge hatch, both of which are equipped with covers. In general, an outlet located at the foundation base of the storage equipment is fitted to allow discharging. To conserve heat and prevent contact with the tank walls, their external surfaces are usually insulated with aluminum-coated glass fiber.