Effect of Iron Ion in the Thermal Decomposition of 50 mass % Hydroxylamine/Water Solutions

Lizbeth O. Cisneros, William J. Rogers, and M. Sam Mannan

Mary Kay O'Connor Process Safety Center
Artie McFerrin Department of Chemical Engineering
Texas A&M University
College Station, Texas 77843-3122, USA

ABSTRACT

This paper presents thermal decomposition behavior of 50 mass % hydroxylamine/water solutions (HA) when contacted with iron in the form of ferric oxide, ferrous ion, and ferric ion. If HA comes in contact with iron ion (Fe$^{3+}$ or Fe$^{2+}$), even in small concentrations and at ambient temperatures, it reacts violently to produce a bubbling system with very little vapor-liquid disengagement. A great amount of energy, ~4.0 kJ/g, is released, in a very short period of time, which results in boiling of the reaction mass. The measured heat of reaction for hydroxylamine without iron ion was 3.78 kJ/g. Rust causes heterogeneous iron catalysis of the reaction, which is not as violent as homogeneous iron catalysis, where even 0.0004 mol % (10 ppm) of iron ion added at room temperature will under adiabatic conditions trigger the complete decomposition of hydroxylamine.