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Calorimetric Study of Epichlorohydrin Reactivity with Water

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Overview:

Epichlorohydrin is a highly reactive chemical intermediate. In its pure form, it is a clear, colorless liquid with a garlic like flavor. The presence of both an epoxide ring and a chlorine atom in the molecule allows Epichlorohydrin to readily undergo a variety of chemical reactions with many types of compounds. This versality earns its wide use as a chemical intermediate.

Epichlorohydrin has many industrial applications when it is converted to bisphenol, a diglycidyl ether, which is a building block in the manufacture of; epoxy resins, synthetic glycerol, and a crosslinking agent for production of Sephadex size-exclusion chromatographic resins from dextran etc.

At high temperatures, it can react violently and some in cases explosively due to spontaneous polymerization in presence of certain substances like acids, alcohols, alkalis, amines, metal oxides, and water. The reactivity of epichlorohydrin with water is studied in detail using an unstirred Accelerating Rate Calorimeter (ARC®) manufactured by Columbia Scientific, Inc. (CSI).

Chemical reactivity studies were performed on epichlorohydrin in three conditions; pure Epichlorohydrin, Epichlorohydrin & Water, and Epichlorohydrin & diluted Nitric Acid. The ARC experiments were run without stirring and with a nitrogen (N_2) headspace.
It was found that epichlorohydrin can react with water and release heat at less than 70°C. Epichlorohydrin reacts at even lower temperature (Near room temp.) in presence of aq. Nitric acid. The test results are shown in in Figures 1 and 2 below. For a more in depth look into this case study, the complete presentation is available at www.belmontscientific.com under the references tab.

Results:

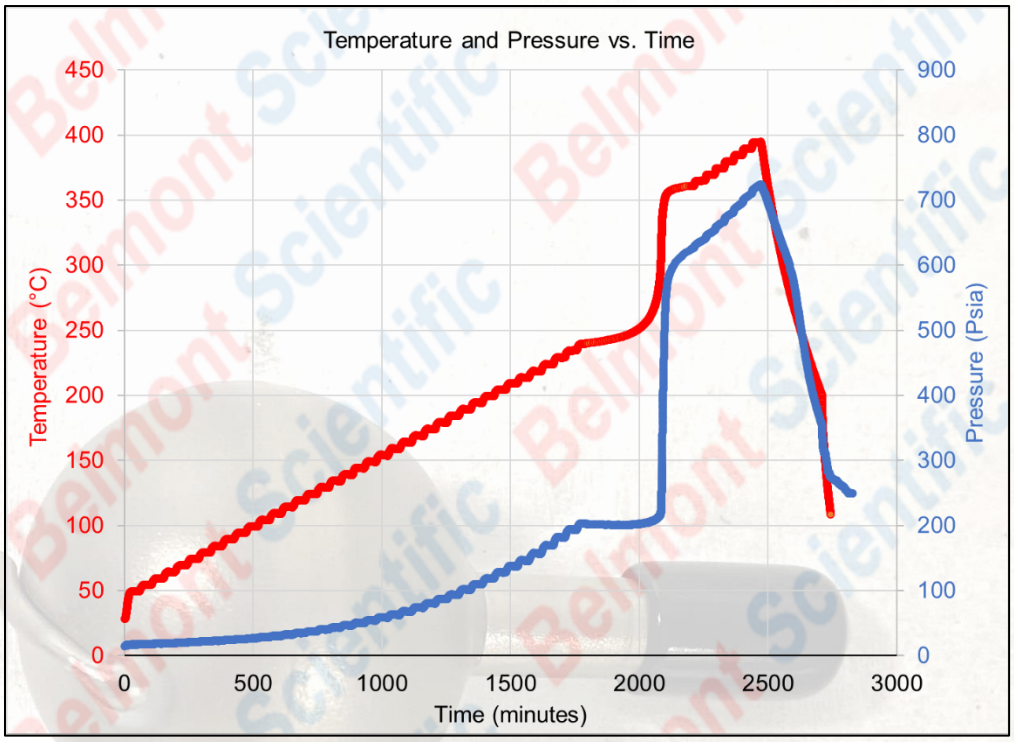

Figure 1. Epichlorohydrin: Temperature and Pressure vs. Time of Pure Epichlorohydrin.

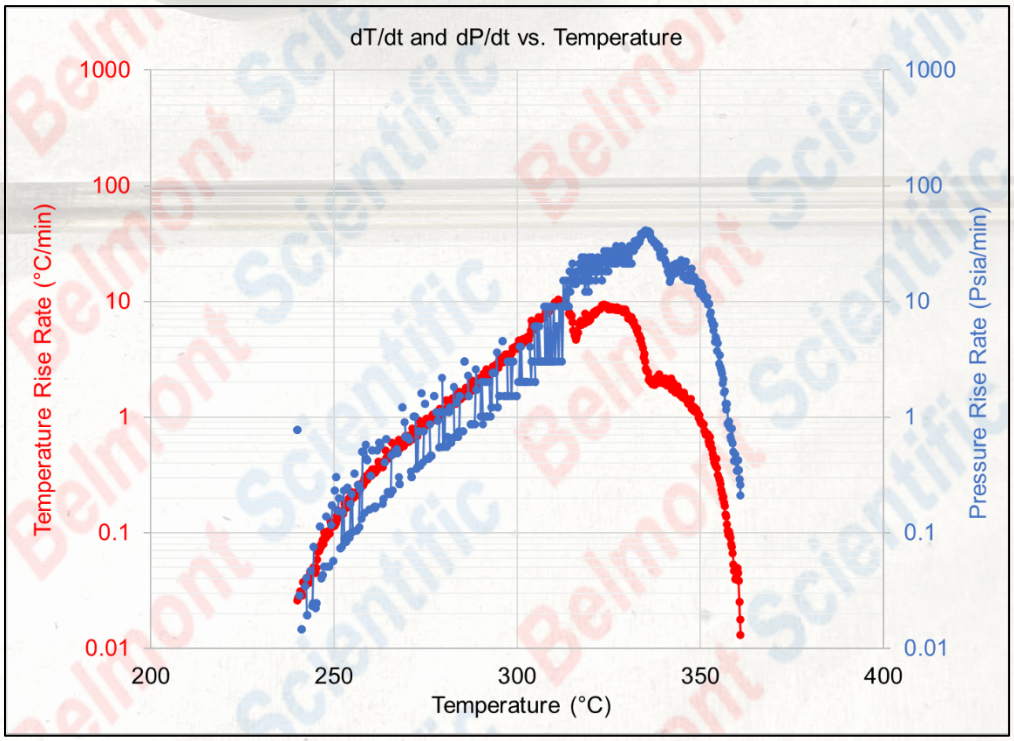

Figure 2. Epichlorohydrin: Temperature Rise Rate and Pressure Rise Rate vs. Temperature.