A Study on the Chemical Incompatibility for Organic Peroxides

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Abstract

This study was designed to investigate chemical incompatibility for organic peroxides such as a Methylethylketone Peroxide(MEK-PO), Benzoylperoxide(BPO) that is most commonly used in the reinforced plastics industry. The chemical incompatibility of the MEK-PO and BPO were carried out using the calorimetric method such as heat-flow calorimetry(DSC) and accelerating rate calorimeter(ARC). Calorimetric method were utilized to quantify chemical incompatibility. The incompatible materials used were acid(H_2SO_4, HCl, HNO_3, CH_3COOH), base(NaOH, KOH), salt($NaNO_3$, KNO_3) and organic material(nitrobezene). Initial exothermic onset temperature(T_a), heat evolution(Q), and adiabatic runaway behavior were used to characterize the incompatibility effects. The test data revealed that the exothermic onset temperature($T_{a,MEK-PO}$) for MEK-PO(55%) are about 98℃ and evolution heat(Q_{MEK-PO}) were about 280cal/g. For MEK-PO and HCl mixtures, $T_{a,MEK-PO}$ were reduced by about 48℃ to 65℃, whereas Q_{MEK-PO} were increased by about 75~353cal/g. $T_{a,MEK-PO}$ were decreased by increaseing of concentration of HCl and Q_{MEK-PO} were incresed by it. The decomposition begins at temperature about 50℃ lower in 0.1N NaOH than for MEK-PO alone. The Initial exothermic onset temperature(T_a) of MEK-PO and 0.1N NaOH mixture with weight ratios of 2:1 to 1:5 were measureed to be 50℃. BPO(95%) decompose at about 107℃ and not influenced by the concentration and guantity of H_2SO_4. But, heat evolution(Q_{BPO}) of BPO and H_2SO_4 mixture were increased by increasing the concentration and guantity of H_2SO_4. The mixture of BPO with potassium hydroxide, potassium nitrate and calcium carbonate have a compatible stability which is approximately the same as a pure compound. However, the stabilities with mineral acid and base are lower. Effects of HCl, H_2SO_4 and NaOH on the instability of MEK-PO mixture were further investigated by ARC. The lower initial onset temperature($T_{a,ARC}$) and shorter of the tmr_{ad} indicate the more incompatible nature of the mixture.

Key Words: Chemical incompatibility, Prevention of explosion·fire of MEK-PO and BPO, Quantitative determination of chemical incompatibility