Explosion in a batch reactor

EPSC Learning Sheet March 2024

EPSC

What Happened:

During the first reaction batch involving hydrogen peroxide and a flammable solvent, an explosion occurred. The hydrogen peroxide produced oxygen at around 30 °C, that displaced the Nitrogen.

Aspects:

- Decomposition of hydrogen peroxide $2\ H_2O_2 \rightarrow 2\ H_2O + O_2$, occurs as of room temperature. This was not known by the HAZOP team nor communicated to the operating crew. The oxygen from the decomposition displaced the initial nitrogen blanket in about 4 minutes.
- An oxygen rich atmosphere can create severe explosions.
- The ignition energy of the gas-phase explosion is reduced by a factor of 100 or more in pure oxygen.
- In the scale-up from the lab to the real size reactor, the nitrogen purge was not included.
- Before doing the HAZOP, assure a good Chemical Hazard Assessment is done that includes understanding of the secondary reactions, DSC data and energy balance.

Hydrogen Peroxide can create a hazardous oxygen atmosphere