Propagation of Lithium Battery Fire in an Inert Environment

International Aircraft Systems Fire
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Background / Introduction

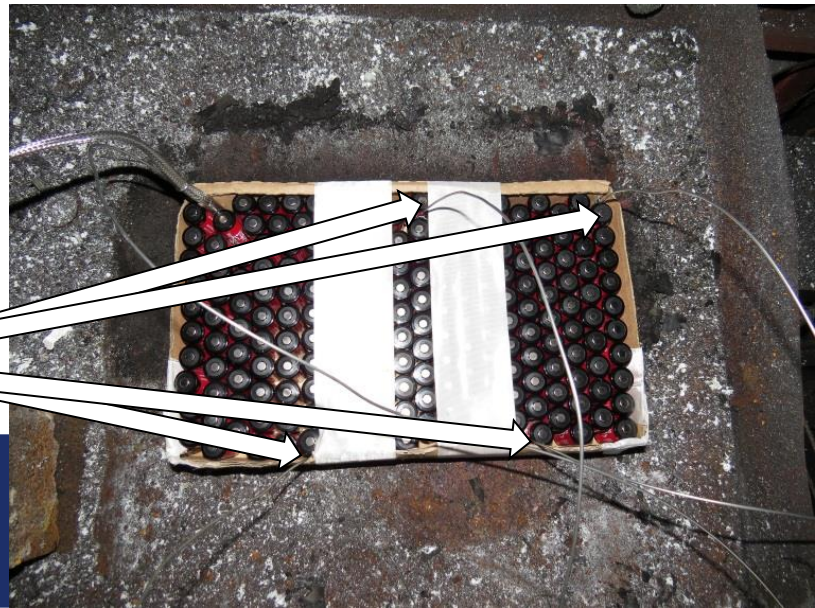
- **Argon propelled foam was proposed as a means of mitigating a lithium battery fire.**
- **Would argon be more effective than nitrogen at suppressing a lithium battery fire?**
  - Heat capacity of Argon: .8637 kJ/m^3 K
  - Heat capacity of Nitrogen (N_2): 1.2116 kJ/m^3 K
  - Nitrogen is more reactive than Argon.

Pressure Chamber

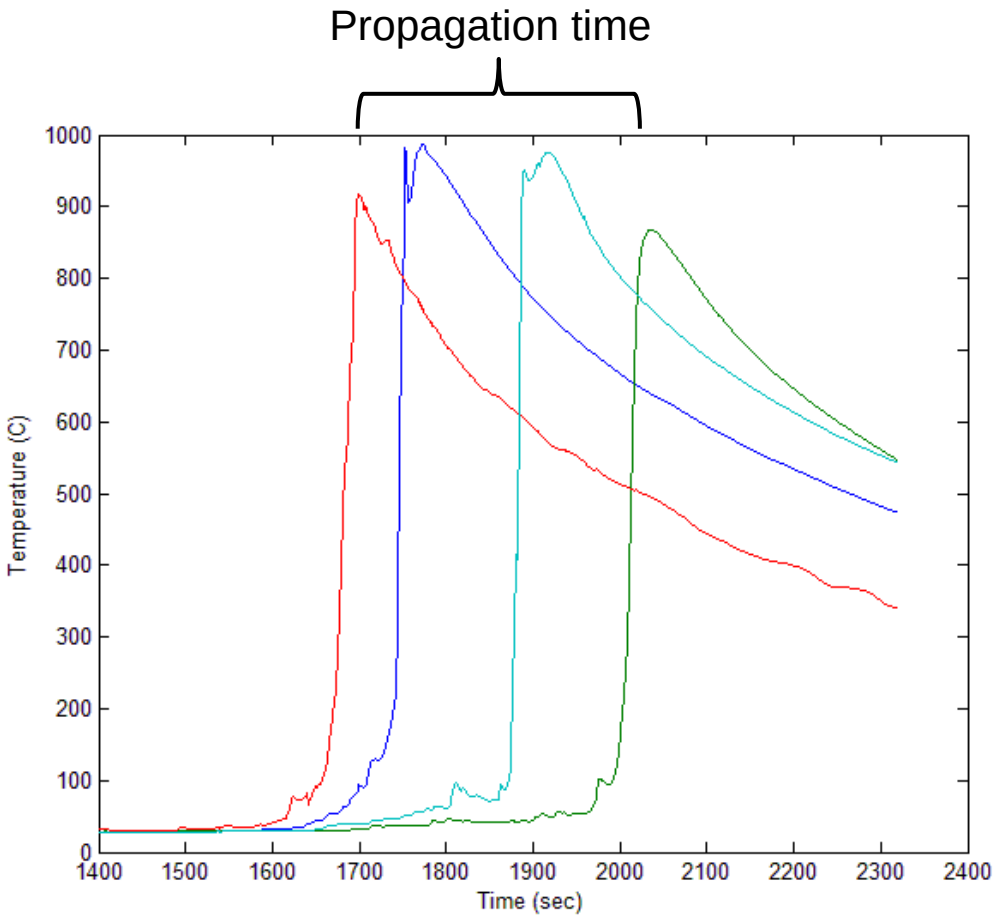
- **Vacuum down to .5 psi**
- **Maximum 750°F at 600 PSI**

Test Setup

- **200 CR123a LiMnO2 cells were positioned in a 10 m^3 pressure chamber.**
- **Tests were first performed in air followed by nitrogen and argon.**
- **For the argon and nitrogen tests partial pressures were used to achieve 9% O2.**



Typical Cell Temp. Plot (N2)



Battery Fires in Reduced O_2 Environment

- **200 CR123A Manganese Dioxide cells in chamber**

Air

Initial O_2: 21%

Propagation Time: 187 sec
O2 Depletion: 7.25%
Max THC: .2237%
Max Ave. Chamber Temp. 118.1C

Argon

Initial O_2: 9%

Propagation Time: 339 sec
O2 Depletion: 3.67%
Max THC: .7394%
Max Ave. Chamber Temp. 165.5C

Nitrogen

Initial O_2: 9%

Propagation Time: 337 sec
O2 Depletion: .633%
Max THC: .8746%
Max Ave. Chamber Temp. 37.63C

Summary

- **Propagation of cells is slowed by oxygen depletion with either Argon or Nitrogen**
- **No noticeable difference in the propagation time when inerted with Argon or Nitrogen**
- **At 9% O_2, Argon was insufficient to fully prevent the battery fire, while Nitrogen did prevent the fire.**

Questions?

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