Honeywell

Flammability Limits of Selected Polymers Commonly Used in American Spacecraft

David Hirsch
Harold Beeson

Aerospace Testing Expo Europe 2006
Hamburg, Germany
April 6, 2006

Honeywell

Topics

- Background
- Review of current evaluation methods of aerospace materials flammability
- Review of flammability limits of commonly used spacecraft materials

Honeywell

Flammability of Flight Hardware - Technical Requirements

- Materials must meet NASA-STD-6001 requirements
- Material Usage Agreements (MUA) for hardware containing materials failing NASA STD 6001 requirements
- MUA's are supported by analysis per JSC 29353, Flammability Configuration Analysis for Spacecraft Applications

Honeywell

Flight Hardware Configuration Flammability Assessment - JSC 29353

- Evaluate the overall hardware configuration
- Evaluate the way in which the hardware will be used
- Identify the major materials to be assessed
- Determine fire propagation paths
- Evaluate ability of containers to contain fire

Honeywell

Test approach

- Modified ASTM D 2863: Upward flame propagation in concurrent flows
- Tests conducted sequentially, with increasing/decreasing oxygen concentrations

Honeywell

Some Polymers Commonly Used in Spacecraft and Their Terrestrial Flammability Limits

- PTFE
- Nomex® HT 9040
- Graphite Epoxy composite
- Viton®
- Polyurethane foam
- Solimide
- Kynar
- Lexan®

Slide 6

d1

PTFE - ISS wire insulation, 49.2
Nomex -
Graphite epoxy composite
Viton
Solimide
Kynar
Lexan
dhirsch, 2/20/2006

Honeywell

Some Polymers Commonly Used in Spacecraft and Their Terrestrial Flammability Limits (Cont'd)

- PVC®
- ABS
- Delrin®
- Kevlar ®
- Silicone
- Epoxy fiberglass composite
- Nylon®

Slide 7

d2

PVC and ABS
Delrin
Kevlar
Silicone
Epoxy glass composite
Nylon

dhirsch, 2/20/2006

Honeywell

Conclusions and Recommendations

- Flame propagation limits determined for common aerospace materials using modified existing test methods will allow extension of the knowledge base for other environments than those which are currently used in spacecraft
- The design of Crew Exploration Vehicle and extraterrestrial habitats may benefit from such data
- Additional evaluations of other advanced materials is recommended