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***Flammability Limits of Selected Polymers
Commonly Used in American Spacecraft***

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

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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



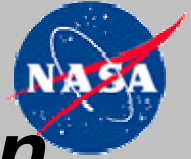
Flight Hardware Configuration Flammability Assessment - JSC 29353

- 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

Test approach



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



Some Polymers Commonly Used in Spacecraft and Their Terrestrial Flammability Limits (% oxygen)

- PTFE 49.0
- Nomex[®] HT 9040 22.6
- Graphite Epoxy Composite 30.9
- Viton[®] 22.5
- Polyurethane Foam 15.3
- Solimide [®] 55.1
- Kynar [®] 34.4
- Lexan[®] 30.1



Some Polymers Commonly Used in Spacecraft and Their Terrestrial Flammability Limits (% oxygen)

- PVC[®] 49.3
- ABS 16.0
- Delrin[®] 11.5
- Kevlar[®] 25.6
- Silicone 23.5
- Epoxy Fiberglass Composite 17.0
- Nylon[®] 23.0



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