

Material Change Similarity Task Group

Proposal to Develop AC Guidance

**Materials Fire Test Working Group
February 23-24, 2015**

Dan Slaton, Boeing

Material Change Similarity Task Group

Presentation Outline:

- Background
- Proposed approach for new AC
 - Minor Change Criteria
 - Flow Chart
- Next Steps

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Background:

March 2014

- Dick Hill presented “FAA Initiatives in Flame Retardant Replacements.”
 - Develop approach to evaluate flame retardant replacements and define similarity.
 - <http://www.fire.tc.faa.gov/pdf/materials/March14Meeting/Lyon-0314-Similarity.pdf>

June 2014

- Dan Slaton presented outline of possible approaches for Task Group.
 - Proposed approach to establish “minor change.”
 - Defined initial scale that demonstrates similarity / equivalency.
 - <http://www.fire.tc.faa.gov/ppt/materials/June14Meeting/Boeing-0614-MaterialChangeSimilarityTG.ppt>

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Background (cont):

October 2014:

- Rich Lyon presented background of MCC activities and similarity approaches.
- <http://www.fire.tc.faa.gov/pdf/materials/Oct14Meeting/LYON-1014-FlameRetardants.pdf>

Similarity

A certified Configuration A is *changed* to Configuration B.

From a certification standpoint, these configurations will be equivalent with regard to safety (similar) if the certification data that substantiates Configuration A also substantiates Configuration B.

In other words A and B are similar if the changes to A, whatever they are, do not impact the original basis for certification.

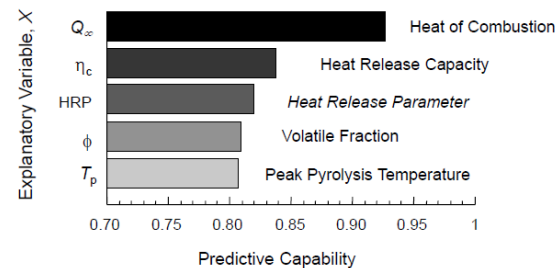
Flame Retardants & Material Change Similarity
IAMFTWG Meeting, Atlantic City, October 27, 2014



Federal Aviation
Administration

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Predictive Capability of ASTM D 7309 Material Properties in Pass / Fail Fire Tests



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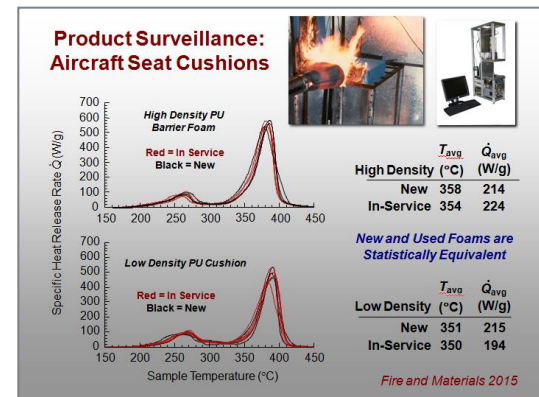
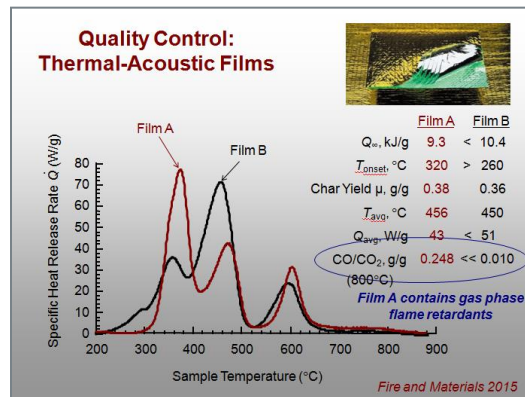
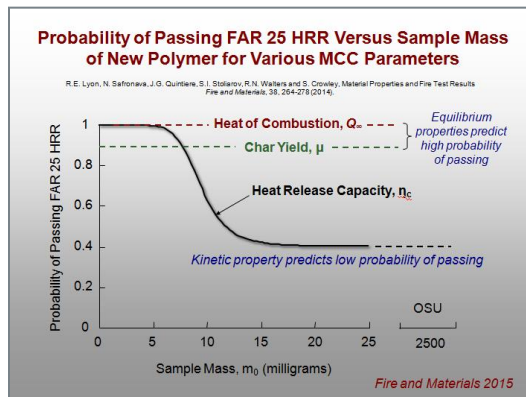
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Background (cont):

February 1, 2015 – Fire & Materials Conference, San Francisco, CA

- Rich Lyon presented “Practical Aspects of MCC.”
- MCC probability of passing FAR 25 HRR based on sample Mass.
- Proposed using MCC for quality control and product surveillance.



- May 2015
- Fire Retardants in Plastics Conference

FIRE RETARDANTS IN PLASTICS 2015

May 12-13, 2015
Grand Hyatt Denver, Denver, CO, USA

11:10 Testing of plastic compounds with milligram-sized specimens for continued UL compliance of combustion characteristics using microscale combustion calorimetry
Mr. Noé P. Navarro, Principal Engineer,
UL LLC, United States

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Background (cont):

UL Literature: UL is implementing the use of MCC for “Follow-up-Service” testing (Yearly Follow-up)

PERFORMANCE MATERIALS

Microscale Combustion Calorimetry (MCC) Testing for Polymeric Materials

A new approach to assess flammability characteristics of polymeric materials

UL's plastic certification program requires Follow-Up Services to conduct surveillance of certified products. Thus, UL is constantly looking for ways to meet these surveillance needs with advanced tools that provide sufficient information for appropriate validation that product requirements are met. With this in mind UL is introducing a thermal and combustion analysis technique for Follow-Up Service (FUS) testing of UL 94 rated products. Using MCC material manufacturers will be able to demonstrate compliance to the certification surveillance requirements for flammability during FUS testing. MCC does not replace the requirement for UL 94 flame ratings in end-product standards; it serves as an additional analytical test to verify material combustion consistency in FUS. MCC will be conducted together with the typical analytical tests used to validate formulation consistency in surveillance of certified plastics, FTIR, TGA and DSC.

What is MCC

MCC is a thermal analysis technique that establishes a procedure for determining flammability characteristics of combustible materials such as plastics. UL uses ASTM D7309, Method B to perform this test. This test is conducted in a laboratory environment using controlled heating of a milligram sized specimen (~2.5 mg) and complete thermal oxidation of the specimen gases. The rate of heat released by combustion of the specimen gases produced during controlled thermo-oxidative decomposition of the specimen is measured from the rate of oxygen consumption. The specimen temperatures over which combustion heat is released are also measured.

A major difference which customers will notice when using this method is that the flame bars are no longer needed for FUS testing, since only a small amount of material in any form, including pellets, is needed to conduct the test.

Application scenarios of MCC

UL's global plastic clients can use MCC test for the following scenarios:

- New Recognition: Establish MCC and ID testing of pellets for FUS. Note: the UL 94 ratings must be assigned based on testing of molded bars, not based on MCC.
- Current Recognition: Discontinue use of UL 94 flame testing for FUS on non-HB rated materials and use MCC instead.
- Non-Conforming Flame Test Results: Differences noted in FUS flame test results can be more extensively investigated using MCC.

Benefits of using MCC

Some of the benefits of using MCC testing for UL's Follow-up-Services (FUS) program are:

- Provides a more quantitative comparison of combustion characteristics of polymeric materials.
- Provides quantitative information that can be correlated to flammability behavior of new formulations that might be useful in new product development.
- Eliminates the need for specimen conditioning inherent in the UL 94 test method, resulting in faster cycle-time to obtain results.

- Eliminates the need for molding, since MCC and ID tests can be done on pellets.
- Eliminates waste associated with molding bars, i.e., no more compounding of extra material to obtain only a limited amount of bars; no need to discard molded unburned bars and unburned portions of bars; no more purging of compounding and molding equipment.
- Significant reduction of combustion byproducts from UL 94 flammability testing.

For additional information about MCC testing please contact:

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Proposal:

- Target – Initially focus on material changes.
- Define MCC test method to establish comparison of material combustion properties of a change in material formulation.
- Establish equivalency of material performance using analysis methodology; e.g. ASTM D 7309-13.
- Equivalent (or better) – Minor change per FAR21.93 (no appreciable effect)

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Classification of Changes to Type Design

§21.93 Classification of changes in type design

- (a) In addition to changes in type design specified in paragraph (b) of this section, changes in type design are classified as minor and major. A “minor change” is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the product. All other changes are “major changes” (except as provided in paragraph (b) of this section).

The intent of this regulation is to ensure that changes to type design are classified as “minor” or “major” based on an assessment of appreciable effect to type design.

14 CFR 21.93(a) classifies the change to type design as “minor” or “major” in support of follow-on regulations 14 CFR 21.95 and 14 CFR 21.97 which define the requirements for approval of minor and major changes respectively.

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§21.95 Approval of minor changes in type design.

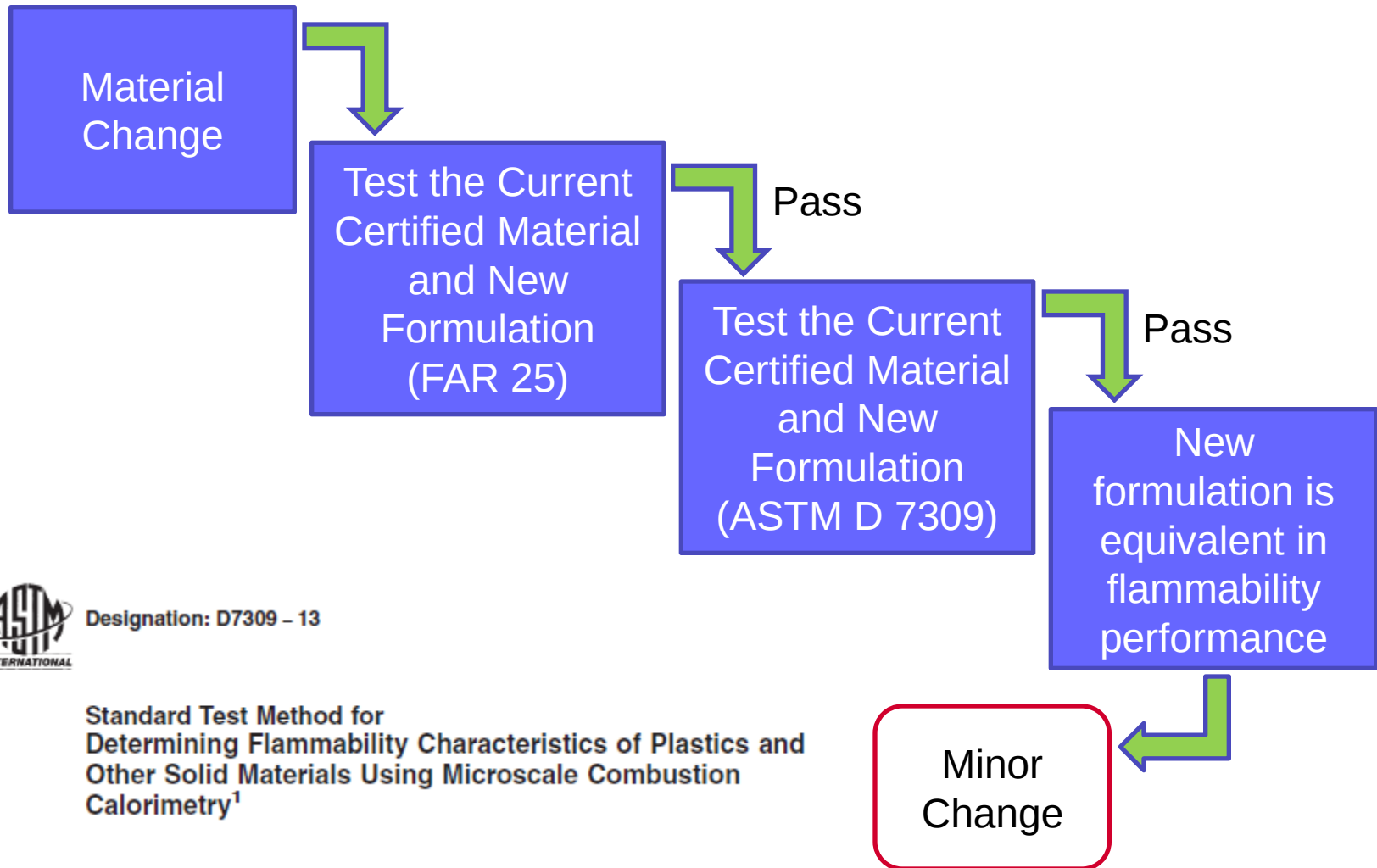
- (a) Minor changes in a type design may be approved under a method acceptable to the FAA before submitting to the FAA any substantiating or descriptive data.

§21.97 Approval of major changes in type design.

- (a) An applicant for approval of a major change in type design must—
 - (1) Provide substantiating data and necessary descriptive data for inclusion in the type design;
 - (2) Show that the change and areas affected by the change comply with the applicable requirements of this subchapter, and provide the FAA the means by which such compliance has been shown; and
 - (3) Provide a statement certifying that the applicant has complied with the applicable requirements.

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Process Proposal:



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Next Steps:

- 1) Task Group discussion.
- 2) Refine process flow.
- 3) Define MCC test method.
- 4) Draft AC.

Links to MCC Reports:

Principles and Practice of Microscale Combustion Calorimetry

<http://www.fire.tc.faa.gov/pdf/TC-12-53.pdf>

A PROBABILISTIC ANALYSIS OF PASS/FAIL FIRE TESTS

<http://www.fire.tc.faa.gov/pdf/TC-12-13.pdf>