An Evaluation of the Oxygen Compatibility of Composite Materials

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Objective: To evaluate the oxygen compatibility characteristics of multiple composite materials

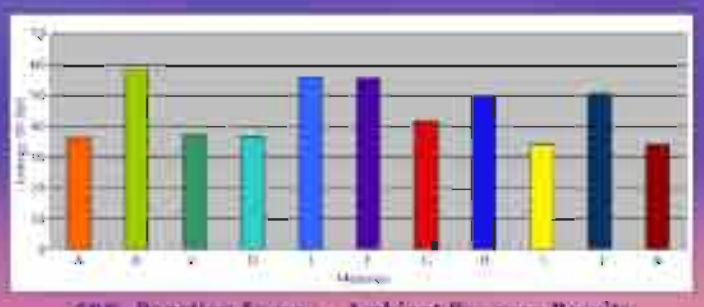
Mechanical Impact Bruceton "Up and Down" Method

The Mechanical Impact Test evaluates a material's resistance to ignition when mechanically impacted. A specimen is immersed in liquid or gaseous oxygen and a 20-lb plummet is dropped from 43.3 in to deliver an energy of 72 ft-lb. A reaction is determined through a flash, audible report, or obvious charring of the sample. The material meets NASA's acceptance criteria if zero reactions are noted within 20 trials at 72 ft-lb.

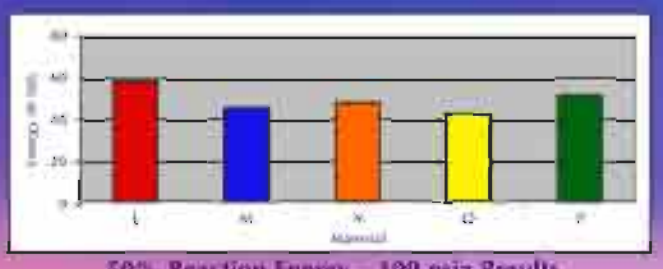
Representative Pretest Photo of Mechanical Impact Test Specimen

Representative Posttest Photo of Reacted Specimens. Note the Charred and Burned Material.

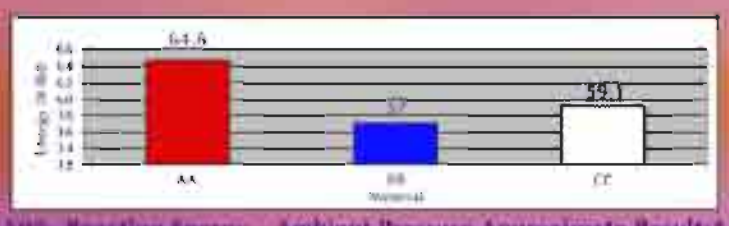
The Bruceton "Up and Down" Method is used to determine the drop height at which 50% of samples tested react. The height is converted to the 50% reaction energy. The test method provides a ranking for the materials — no pass/fail criteria exist for the method.



50% Reaction Energy – Ambient Pressure Results

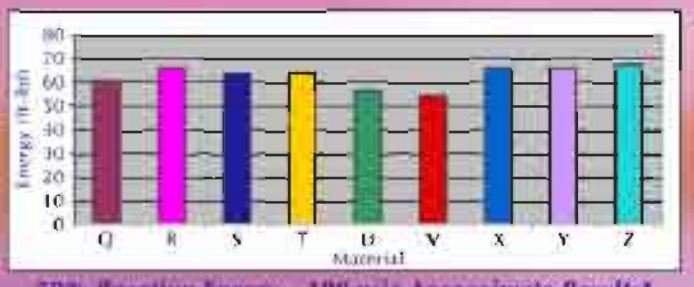


50% Reaction Energy – 100 psia Results



50% Reaction Energy – Ambient Pressure Approximate Results*

*Results are approximate as samples did not react consistently at the highest energy level tested.



50% Reaction Energy – 100 psia Approximate Results*

*Results are approximate as samples did not consistently react at the highest energy level tested.

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Promoted Combustion

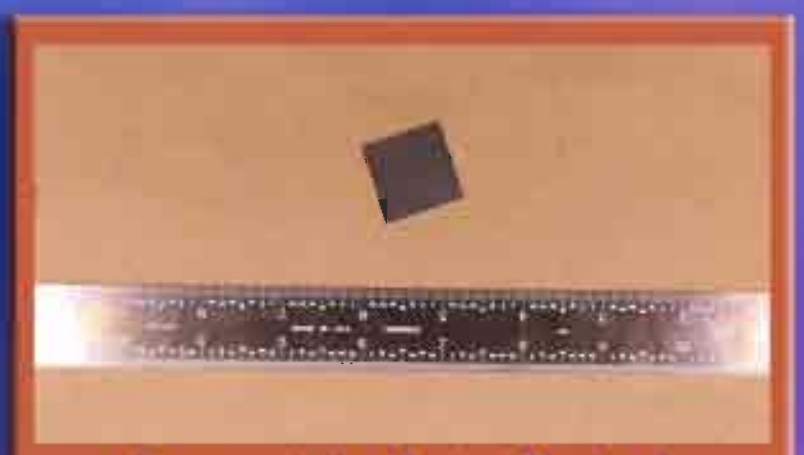
The Promoted Combustion Test evaluates the flammability characteristics of a material in 100% gaseous oxygen (GOX) when ignited at the bottom by an aluminum promoter. The specimens are 12 in long, and a minimum of five specimens must be tested. A material is considered flammable at the test conditions if one specimen burns more than 6 in.

Representative Pretest Photo of Promoted Combustion Specimen

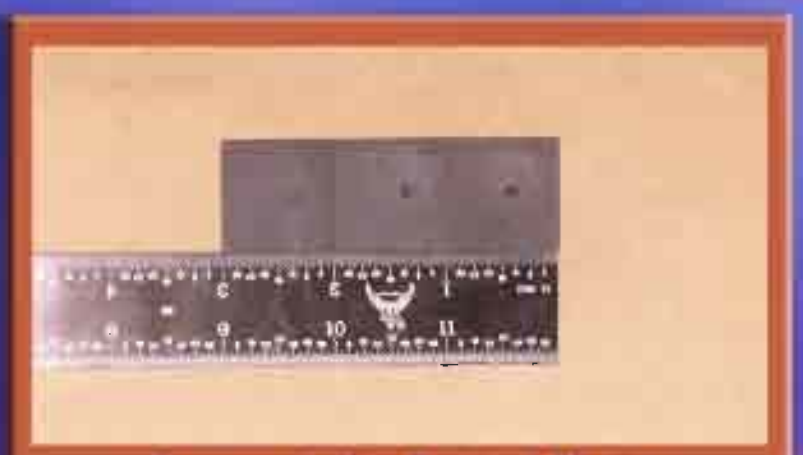
Promoted Combustion Burn Lengths – 50-psia GOX

Electrostatic Discharge

The Electrostatic Discharge (ESD) Test evaluates whether a spark is a credible ignition source for a material used in an oxygen environment. A specimen is placed in a box that is purged with gaseous oxygen for 20 to 30 s. The specimen is tested when a 5000-V, 112.5-J spark is discharged onto the surface of the specimen. A material is considered to be susceptible to ignition by ESD if it ignites and burns.



Representative Pretest Photo of Electrostatic Discharge Test Specimen



Representative Posttest Photo of Electrostatic Discharge Test Specimens

Note the surface imperfections caused by the discharge. No specimen ignited and burned.

For further information concerning this poster presentation or for other oxygen compatibility test services, contact Erin Richardson, ED36, Chemistry Group, Marshall Space Flight Center, Alabama.

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