Standard Chemical Ignition Source Characteristics for Flammability Testing

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Problem: Validation data were needed for igniter performance

Chemical Igniter

Composition of Chemical Ignitors Used in Material Flammability Testing

70.3% Hexamethylenetetramine $(CH_2)_6N_4$

26.3% Anhydrous Sodium Metasilicate (Na_2SiO_3)

3.5% Arabic Gum – Acacia Gum (Carbonydrate Polymer); Water Soluble

Performance Specifications

Flame Temperature: 1100 ± 30 °C (2000 ± 160 °F)

Ignitor Burn Time: 25 ± 5 s

Peak Flame Height: 6.4 ± 0.64 cm (2.5 ± 0.25 in)

Test Results:

Figure 1. Equilibrium Chemical Igniter Weight Ratios as a Function of Humidity Level

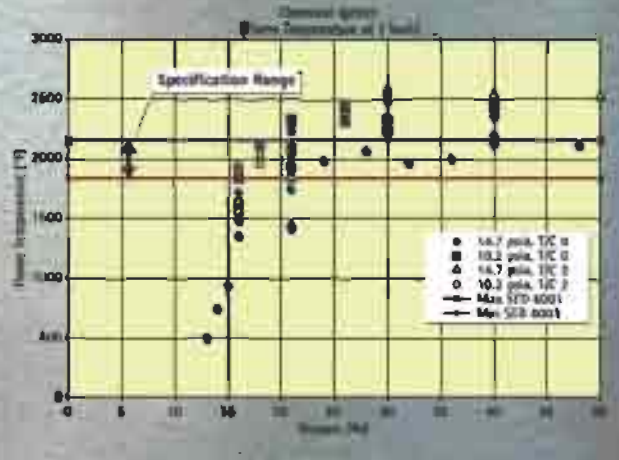

Figure 2. Igniter Flame Temperature at 1 inch

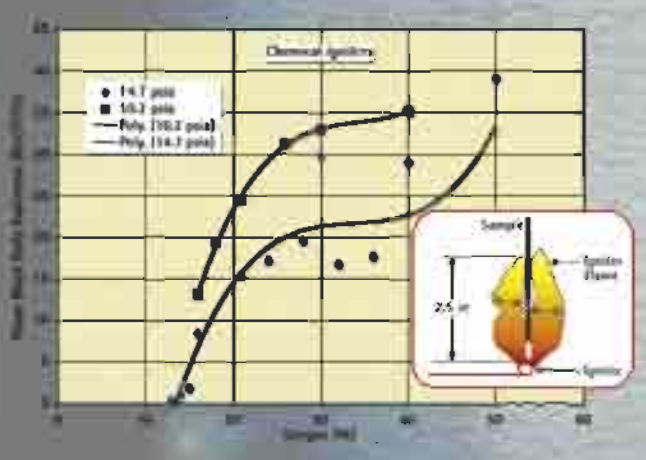

Figure 3. Flame Black Body Radiation

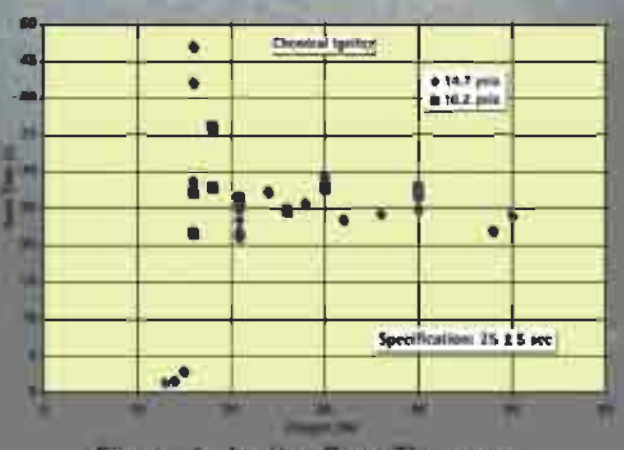

Figure 4. Igniter Burn Time as a Function of Oxygen Level

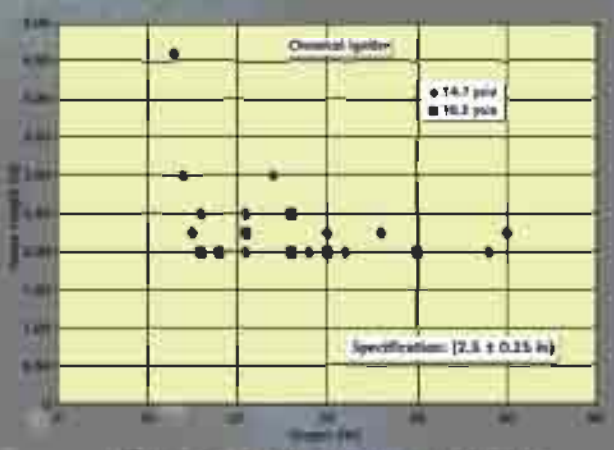

Figure 5. Maximum Flame Height

Conclusions:

- Chemical igniter weights: determined to be within the STD 6001 range; form normal distribution across range; average weight = 0.2168 g
- Humidity effects: minimal when humidity <40%; potentially very significant effects when >40%
- Igniter flame temperatures: drop <1840 °F at <18% O_2 conditions; measured >2160 °F for 10.2 psia and >20% O_2
- Potential radiation heating from igniter flame to sample changed from 16 to 35 Btu/ft^2/s when changing from 20% to 50% O_2 at 14.7 psia. Temperature implied radiative heating was always higher for lower pressure (10.2 psia) than for higher pressure (14.7 psia) at the same O_2 level
- Flame height: outside specifications 60% of the time
- Burn time correlated by burn weight; within specifications for >20% O_2 concentrations
- Demonstrated capability of LabVIEW™ data acquisition system to capture transient data for new MAPTIS system

Qualis

MSFC Materials Combustion Research Facility

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