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Sub-atmospheric bursting ignition of fluorinated ethylene propylene wire insulation

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Abstract

Fire-resistant materials, such as fluorinated ethylene propylene (FEP), are used to coat wires in spacecraft. However, their bursting ignition has not been investigated sufficiently. In this study, the pilot ignition of the FEP wire insulation was assessed in a sub-atmospheric pressure test chamber while applying constant high current. The results revealed that the FEP insulation induced bubble formation as pyrolysis gases accumulated gradually between the wire core and the insulation. The bubble burst when the inner pressure exceeded the surface tension of the insulation and was accompanied by the release of a volatile gas jet, which mixed with air and was ignited by the red-hot metal core. The expansion stress was higher toward the wire center, so bursting was more probable at the center. The ignition delay consisted of the bubble bursting time, mixing time and chemical reaction time, with a significant proportion occupied by the bursting time. Moreover, the ignition delay decreased with pressure and oxygen concentration. Although the mixing time increased with pressure, the Damköhler number was proportional to the square

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