Fire and Toxicity Test for Seats

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Phase II: US ARMY CCDC project on Seat Flammability and Toxicity

Abstract

A test protocol is developed for assessing the fire hazard of a seat configuration in a combat vehicle. The hazards include the thermal hazard based on the potential ignition of an adjoining seat, and toxic hazards from asphyxiant and irritant gases. Fire properties of the chair cushion ensemble were developed using a Cone calorimeter over a range of heat fluxes. A special ensemble sample was designed to ensure one-dimensional burning. The properties include the Critical Heat Flux, the Thermal Response Parameter, the Heat Release Parameter, and the Available Energy Parameter. An analysis was developed to determine the critical material fire properties that meet a safe level performance. The safe level is defined to consist of the prevention of ignition of the chair in less than 2 minutes or the prevention of the ignition of an adjoining seat, and no incapacitation of the occupants for up to 5 minutes. Performance decrements due to eye and respiratory irritation from irritant gases are also considered. Experiments and analyses were conducted to develop the relationships for the critical fire properties in terms of physics and human tolerance to fire gases. A recommended level is based on that analysis and the incorporation of safety factors or conservative criteria. The analysis consists of an engineering design that should clearly show the rationale for the protocol and a foundation for modifying it in the future based on new knowledge and information. The accuracy of the analysis is demonstrated based on free burns of seven chair configurations and one burn in a Mockup combat vehicle.