

Firefighter Garment Based Carbon Foam Fabric

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The proposed research work is a numerical study to investigate and predict the effect of utilizing different carbon foam fabrics as alternative materials for both outer shell and thermal liner layers in firefighter garments. Incorporating the advantages inherent in both cellular and carbonaceous materials, carbon foam has been considered as a material of great promise in a variety of applications. Rocket nozzles, advanced tooling, engine components, and as a core material in sandwich structures have all employed carbon foams due to their extremely light weight and optimum mechanical and thermal properties. Furthermore with a specific modulus rivaling that of a Kevlar honeycomb, carbon foam has even been suggested as a replacement for a vast array of materials ranging from balsa wood and polymer matrices to metallic honeycombs and titanium for use in biological applications. According to its porosity and ligament structure, carbon foam would be utilized as an excellent insulator. On the other hand, every firefighter's turnout is a composite of three components: an outer shell, a moisture barrier and a thermal liner. The outer shell is designed to take the everyday abuse of firefighting. This outermost layer is designed to protect the inner components from thermal hazards, abrasion, sunlight and other factors involved in fighting fires. The moisture barrier layer, an impermeable liquid film laminate protects against the intrusion of water, chemicals or viral agents. The thermal liner provides the most thermal insulation by trapping air in either a traditional needle-punched batt or between multiple layers insulation. The durability of this layer is improved by quilting these materials. The combination of all three of these components will define the performance characteristics of the entire composite system. Thermal Protection Performance, total heat loss, system weight and many other criteria will define how a specific combination performs and feels. As a conclusion: by combining its inherent properties and its ability to be used in biological applications, carbon foam would be an excellent material to be used as the outer shell and thermal liner layers in firefighter's garment.



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