Introduction

Activated carbon can be incorporated in various forms into permeable materials for use in protective clothing. Garments made of these materials are sorptive to chemical vapors and aerosols and could be used to prevent contact of chemicals with skin of personnel in areas where chemicals are manufactured or used. Such garments would thus reduce or eliminate real and potential hazards to chemical plant or laboratory workers who may be exposed to harmful chemicals which can be absorbed through the skin. Garments of this type are generally more comfortable than nonpermeable protective gear because they are air and moisture permeable.

Sorptive textile materials having potential for use in garments can be made in various ways. These include surface coatings with activated carbon powder, impregnation with activated carbon powder, and carbonization and activation of a suitable yarn or fabric precursor.

Surface Coatings

Surface coatings can be applied by dusting the powder onto a fiber, fabric, or porous film but the amount of activated carbon deposited in this manner is severely limited by surface area of the material and low adhering forces. Fabric, of course, holds more of the carbon powder than film or fiber because of the many fibers or yarns in fabric, but it does not adhere well. One potential solution to this problem is to use a suitable binder with the carbon. Evaluation at the US Army Natick Research and Development Command, Natick, of a carbon/binder mixture applied to a solid monofilament of nylon has indicated that considerable additional research would be required to prevent rupture and flaking of the coatings when the filament bends, and rubs against another. Similar problems were anticipated with film and fabric so this method was abandoned in favor of other approaches.

Impregnation

Impregnation of various materials with an activated carbon powder slurry containing an acrylic latex binder has met with more success than filament coating. Treatments of this type have been applied to woven fabric, non-woven fabric and foam. Each of these types of treated material was prepared from an aqueous slurry of the carbon by immersion of the material in the slurry, squeezing out the excess between two rolls and drying the product. Sometimes more than one immersion is necessary to obtain a desired add-on or the slurry. By varying the amount of carbon in the slurry and the number of immersions it is possible to obtain maximum sorptivity consistent with fabric capacity. A tightly woven fabric has less capacity or void space for such a slurry than does a loosely woven or loosely constructed non-woven fabric. An open celled foam has the largest capacity. Fabrics which have been investi-