

***STATIC ELECTRICITY HAZARDS
OF TRIBOELECTRICALLY
CHARGED GARMENTS***

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Introduction

This technical report is intended to provide some insight to the electrostatic hazards present when a garment is worn in a flammable or explosive environment. The primary focus from the military application standpoint has been in the area of chemical defense ensembles, although this report may be applied to textiles in general. A brief overview of electrostatic charge generation and charge dissipation is also presented.

Background

ESD testing of chemical defense ensembles have been conducted by the various military services in recent years. A variety of evaluation methods have been used for material screening purposes and for system level tests. Some of the evaluation methods used for material screening purposes have included surface and volume resistance/resistivity tests such as ESD S11.11-1993 and ESD DS11.12-1996¹. Another evaluation method used for material screening purposes has been FED-STD-191A, method 5931, "Determination of Electrostatic Decay of Fabrics". System level tests conducted while wearing the garments have typically consisted of measuring electric field strengths after the wearer performs some type of simulated work task or by tribocharging the garment by some means. There are some potential problems with these test procedures, and these concerns will be addressed later in this report.

Chemical Defense Ensemble Electrostatic Requirements

Typical operational requirements documents traditionally have stated that chemical defense ensembles must "have non-hazardous surface resistivity and/or electrostatic decay/dissipation characteristics". Unfortunately, to date, these requirements haven't been clearly defined.

Overview of Electrostatic Charge Generation

"Charge generation" is a term that is often used to describe the accumulation of charge on an object as a result of tribocharging. Tribocharging refers to the physical contact and separation of two materials that results in a transfer of charge. As stated, charge is not actually generated, it is simply transferred from one material to the other. The polarity and magnitude of charge transfer is dependent upon the types of materials used, the nature of contact, the environmental conditions, etc. Readers new to the subject of tribocharging looking to obtain a better understanding of the subject, may wish to reference ESD ADV11.2-1995 as an initial starting point². It is important to understand that material "A" may exhibit little tribocharging with material "B", but may exhibit substantial tribocharging with material "C".

In the interest of safely controlling ESD events, it is desirable to have materials that exhibit a low propensity to charge through tribocharging, in addition to having charge dissipation characteristics.

Overview of Electrostatic Discharge (ESD) and Associated Hazards

¹ Electrostatic Discharge Association; ESD S11.11-1993, "Surface Resistance Measurement of Static Dissipative Planar Materials"; ESD DS11.12-1996, "Volume Resistance Measurement of Static dissipative Planar Materials".

² Electrostatic Discharge Association; ESD ADV11.2-1995, "Triboelectric Charge Accumulation Testing".