

## Letter to the Editor: Assessing the electrostatic suitability of cleanroom garments

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I understand from the recent publication of the IEC 61340-9-4 document "Electrostatics - Standard test methods for specific applications - garments" that the electrostatic suitability of garments is to be judged solely on the basis of resistivity measurement. I think it will be useful for readers to appreciate the limitations of this approach.

Measurement of surface resistivity is not an adequate approach for assessing the electrostatic suitability of materials for the following reasons:

- 1) In the semiconductor and pharmaceutical industries people use garments that are basically a polyester fabric with conductive threads included to help control static risks.
- 2) The aim of such static control measures is to limit the voltages that may arise on garment surfaces due to physical contact or rubbing actions with other surfaces. These voltages will create electric fields and induce charge on any nearby static sensitive devices and/or systems.
- 3) The polyester fabric itself is a very insulating material. The threads are introduced as a fairly open grid or stripe pattern. The conductive threads cover only a very small fraction of the surface area so their influence is very localized. This means that from the electrostatic point of view and from the point of view of measurement of surface resistivity the surface of the material is very inhomogeneous.
- 4) When the surface of such materials is contacted or rubbed the influence of the separated surface charge on items nearby will be very different for charge separated on areas between the threads compared to that of charge separated close to the threads.
- 5) Some garment makers use fabrics with conductive threads that have a surface conductivity, others use conductive threads where the conductivity is as a core of the thread and sheathed with polyester.
- 6) Fabrics that include threads with surface conductivity are likely to pass a standard surface resistivity test. Those with core conductivity threads will fail.
- 7) Fabrics including either type of conductive thread can be judged electrostatically acceptable by the companies that use them. This raises the question as to how the electrostatic characteristics should be assessed
- 8) Studies that have been made with inhabited garments, where surface charge has been created by short term local tribocharging actions. These studies showed that the surface voltage created per unit of charge is comparable between fabrics with surface and with core conductive threads. The results of these studies were published in 2008 [1,2].
- 9) These studies also showed that for both surface and core conductive threads the main factor limiting the surface voltage is the spacing between the conductive threads. Resistivity is not a relevant parameter.
- 10) Appreciable voltages can be created on garments that pass resistivity testing – but voltages are constrained to comparable levels for the same amounts of charge for garments with core conductive threads that fail resistivity testing.
- 11) On the basis of such results it would be appropriate to look again at the objectives and suitability of test methods used to assess materials
- 12) There are a number of test methods available and in commercial use for assessing the electrostatic suitability of garments and fabrics. Those that rely on creating a surface potential by connection to a voltage source are not appropriate. No such approach achieves reliable charging of the fabric surface between the conductive threads. This is the area of the fabric where retained static charge will have the

greatest influence on items nearby after the fabric has been charged in practice by contact or rubbing. Equally methods that rely on charging the fabric and then connecting a boundary to earth are not appropriate – this is not the practical situation. The only suitable methods of testing are those where charge arises on the surface by tribocharging or by corona charging and where the fabric is supported or used as in practical application.

[1] J N Chubb, P Holdstock "*Tribocharging studies on inhabited cleanroom garments*"  
J. Electrostatics 66 2008 p531-537

[2] J N Chubb "A prickly issue" Cleanroom Technology March 2009

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