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‘FIBC’ IGNITION RISKS FROM STATIC ELECTRICITY

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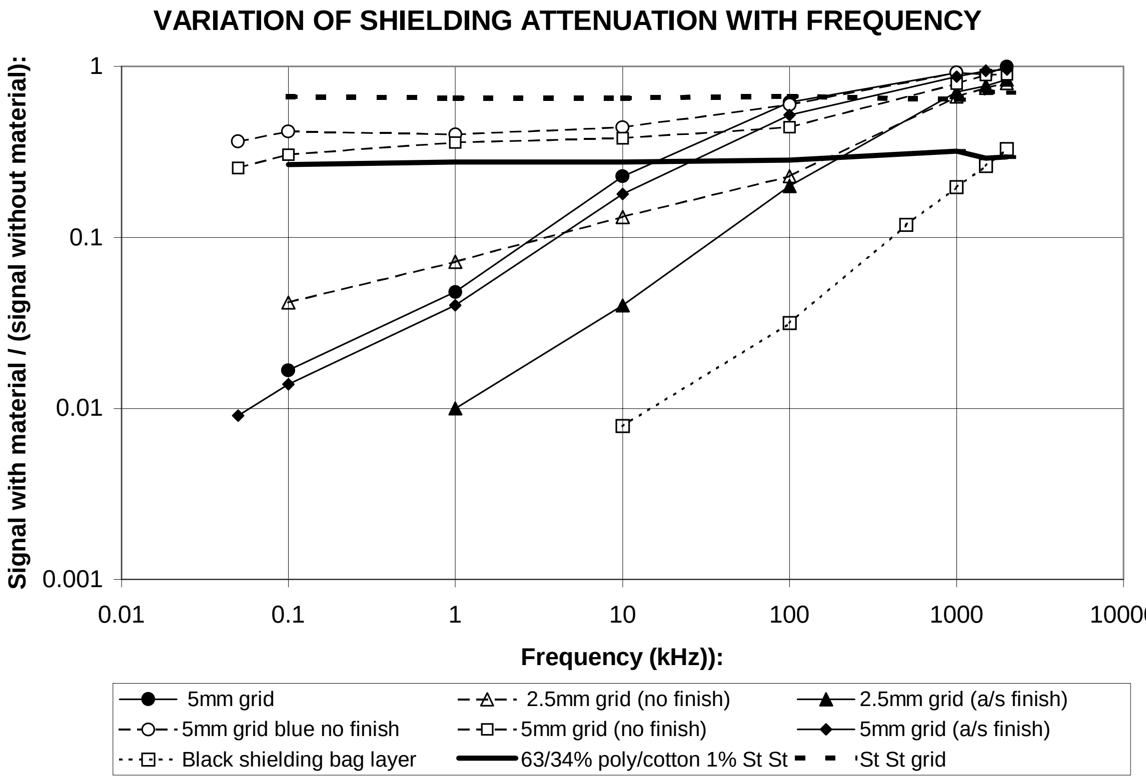
Conductive threads are often incorporated into the fabrics used for FIBCs (as they are into personnel protective clothing) for use where flammable atmospheres may be present. The Type C construction of FIBCs requires that these threads be bonded to earth. It is not easy to feel confident in achieving this over extended operating lifetimes. There is the view that the Type D construction, which does not require earth bonding, can be acceptable. Critical aspects in the design of unearthed Type D bags are whether an electrostatic discharge to a bag containing charged material can get rapid access to sufficient electrostatic energy to provide a source of ignition of any flammable materials nearby (gases or dusts). The charge to feed an electrostatic discharge could come from material within the bag, but more probably from the outer bag surface. Charge on the outer surface of the bag will probably prevent any significant electrostatic discharges from within the bag. The prime concern is hence with charge on the outer surface. If the bag surface is a good quality insulating material then an initial discharge to an earthed probe approaching the charged bag will spread outwards over the charged surface until the radial electric field at the edge of the discharge can no longer support further propagation. By making the surface ‘resistive’ the radial propagation of the discharge can be limited and the opportunity for incendive discharges greatly reduced. Making fabrics ‘resistive’ within the appropriate range (around 10^8 ohms [1]) would not be easy. Use of ‘conductive threads’ of appropriate resistivity is likely to achieve a similar control much more easily. The threads are likely to limit radial propagation of the discharge so long as the resistivity of the threads prevents charge being drawn in rapidly from the net of threads. Clearly interconnected metallic threads would be quite inappropriate!

The use of threads with ‘core conductivity’ is attractive as such threads have a high ‘resistivity’ and will not interconnect, except to a very minor extent by capacitance at any thread crossovers. A problem with this type of thread is to know their characteristics because you cannot reliably get access to measure thread resistance. Work is to be reported at the IEEE-IAS meeting in Rome in October [2] will show how the resistive characteristics of conductive threads in fabrics, and the influence of any antistat surface treatment, can be measured non-invasively. The approach is to measure the variation of shielding performance as a function of frequency. Figure 1 below shows measurements on a few practical materials. The materials here all show a reduction of shielding attenuation to near zero by 2MHz or so. Where similar measurements are made for fabrics including metallic conductive threads the shielding performance depends on the amount of metal thread present and is clearly independent of frequency over this range.

What is now needed is experimental matching of the variation of shielding performance with frequency to the chance of ignition by electrostatic discharges. The model proposed for assessing materials is plausible - but is in need of quantitative confirmation.



References:

[1] G. J. Butterworth, E. S. Paul, J. N. Chubb "A study of the incendivity of electrical discharges between planar resistive electrodes" *'Electrostatics 1983'* IoP Confr Series 66 p185

[2] J. N. Chubb *"Measuring the shielding performance of materials"* IEEE-IAS Meeting, Oct 8-12, Rome