Variation in Static Dissipation Time with Surface Resistivity

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***Abstract*— The static dissipation time [1] and the surface electrical resistivity [2] are commonly used to specify the static performance of plastic films and sheets. For ohmic conduction, the charge relaxation time is proportional to the surface resistivity [3]. However, current flow on the surface of plastics is often non-ohmic. Analysis presented here shows that the static dissipation time depends on the surface electrical resistivity, the number density of charge carriers present on the surface, the mobility of the charge carriers and on the measurement geometry. The key finding is that the surface electrical resistivity systematically underestimates the static performance of the plastic material.**

Previous analysis the measurement of DC resistivity [4] suggests that a reservoir of charge carriers is present on the surface of plastics. In response to a step voltage, the mobile charge carriers respond and the current is initially high. During a period of time that can last many seconds, the current decreases as the charge carriers accumulate near the measurement electrodes. Eventually, the current becomes steady and the ohmic DC resistivity can be measured. Note that the DC resistivity systematically eliminates the charge dissipation from the reservoir of charge carriers.

The static dissipation measurement method is modeled using a rectangular boundary value problem. One of the boundaries requires a mixed boundary condition. The solution is obtained to find that static dissipation time is proportional to the ohmic surface electrical resistivity. The analysis is extended to find that the static dissipation time depends also on the number density and mobility of charge carriers present on the surface.

REFERENCES

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