ASSESSING THE SUITABILITY OF MATERIALS

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John Chubb Instrumentation

Best way to avoid problems from static (and best constructive use of static) is to get right the characteristics for the materials

To know what you have got requires measurements.

Electrostatic 'performance' features:

- *charge decay time*
  (to drain charge away)
- *capacitance loading*
  (to control initial peak voltage)
- *shielding*
  (reduce influence of electric field transients)
- *opportunity for incendive discharges*

This paper concerned with measurement of:

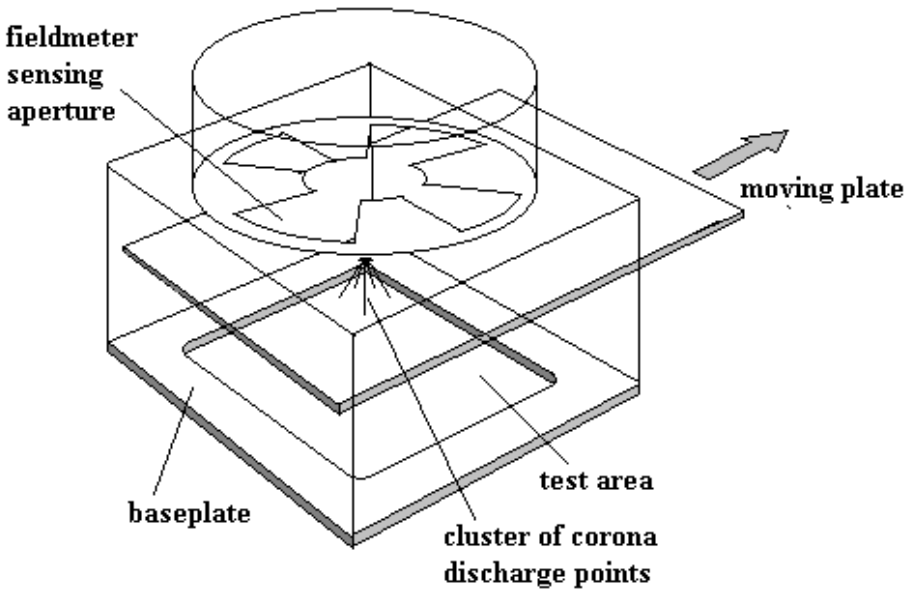
- *charge decay*
- *capacitance loading*
- *shielding*

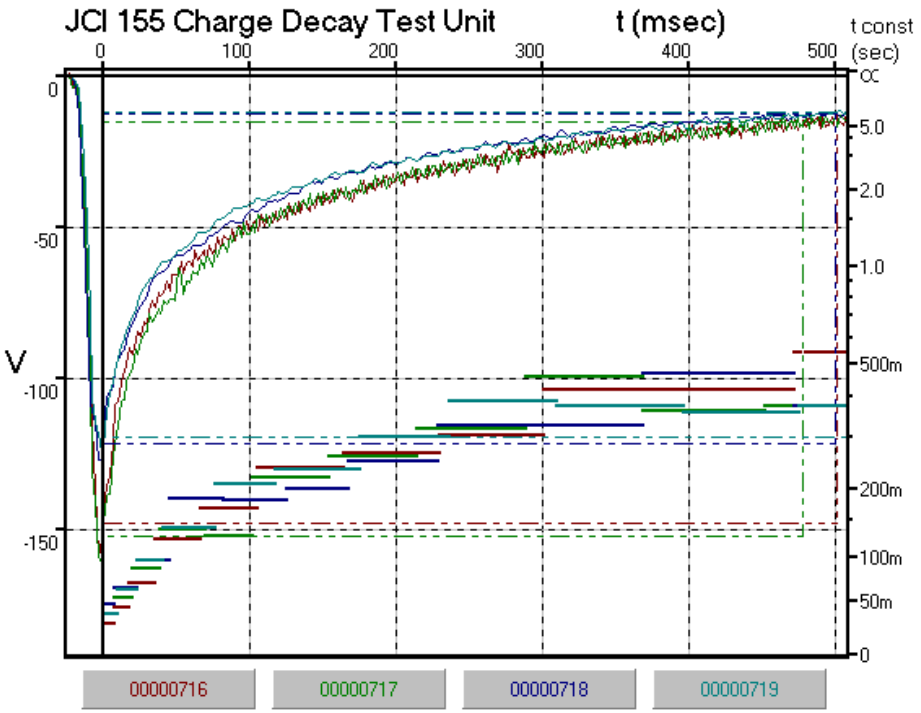
Charge decay measurement

Method of measurement must give results matching tribocharging.

Corona charging shown to give comparable results.

- *easier for practical studies*
- *controlled test conditions*
- *operator independence*





Example charge decay curves for paper card

Performance:

- *time from initial peak voltage to*
  - *1/e (37%)*
  - *10%*

Capacitance loading

Initial peak voltage created by tribocharging depends on capacitance experienced by surface charge.

Any material including high conductivity layer will show high capacitance

Capacitance can usefully limit voltages (and hence problems) with electronic packaging (also for cleanroom garments)

Paper exhibits a high capacitance

Most thin layers of thin simple plastics show low capacitance

– so not useful for limiting surface voltages

***Measured** from:*

- *initial peak voltage*
- *quantity of charge*

Normalised as ratio to thin layer of good dielectric

Suitability of materials:

- *if decay time is short: no problem*
- *if capacitance loading high: possibly no problem*
- *if capacitance loading low and decay time long: then problems*

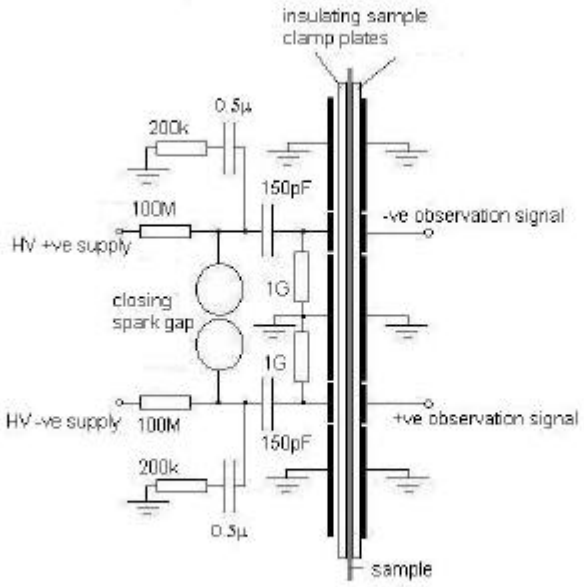
General: *performance may be improved by antistat additives – volume/surface.*

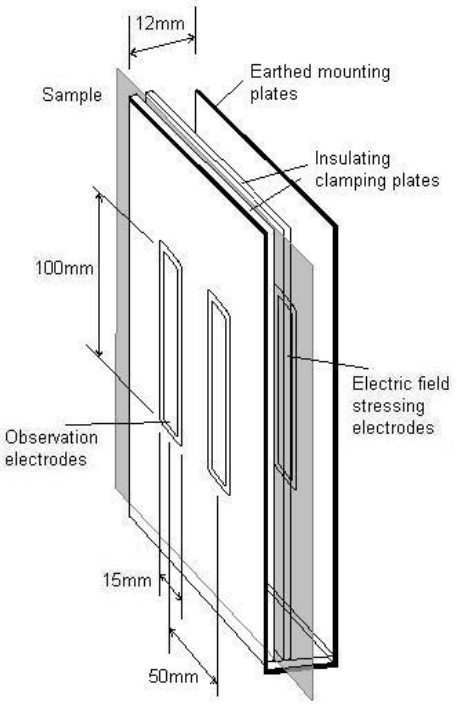
<u>Beware</u> influence of humidity!

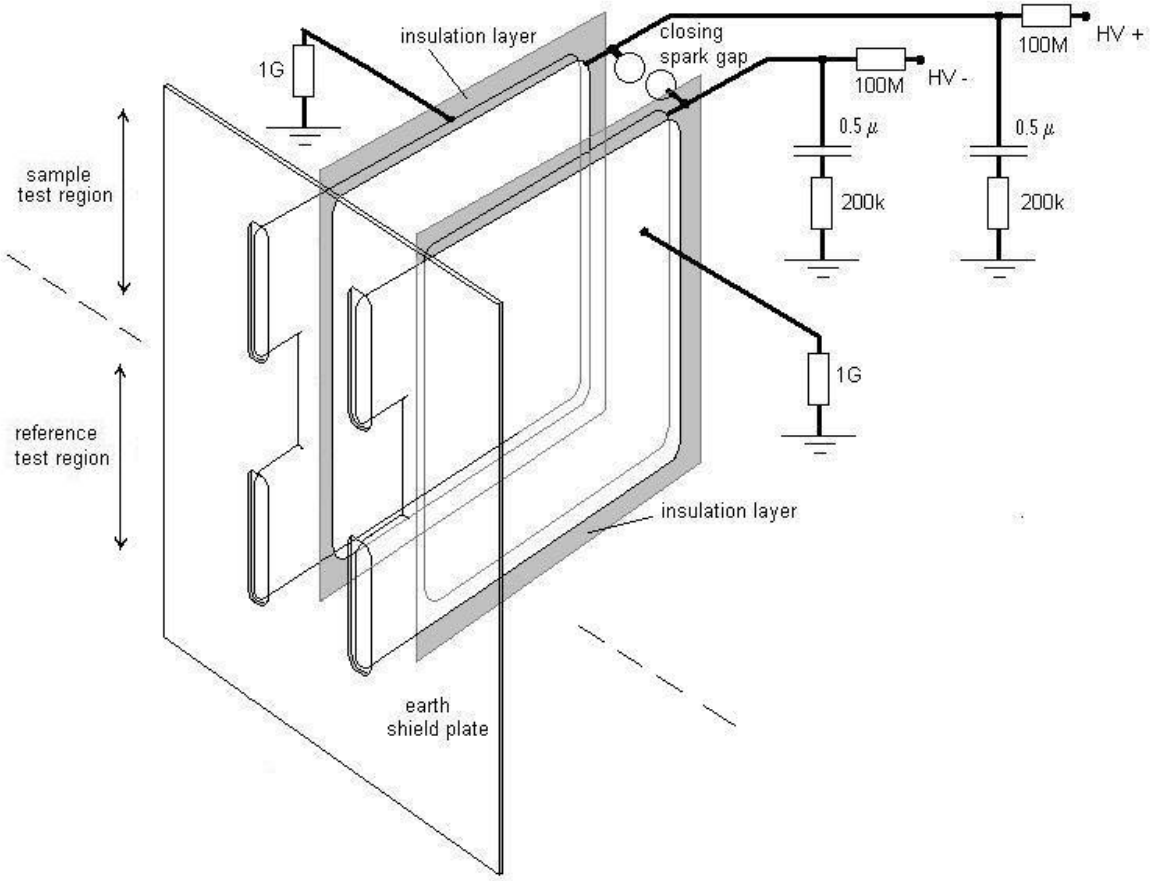
In-plant: *performance may be improved using air ionisation*

Shielding

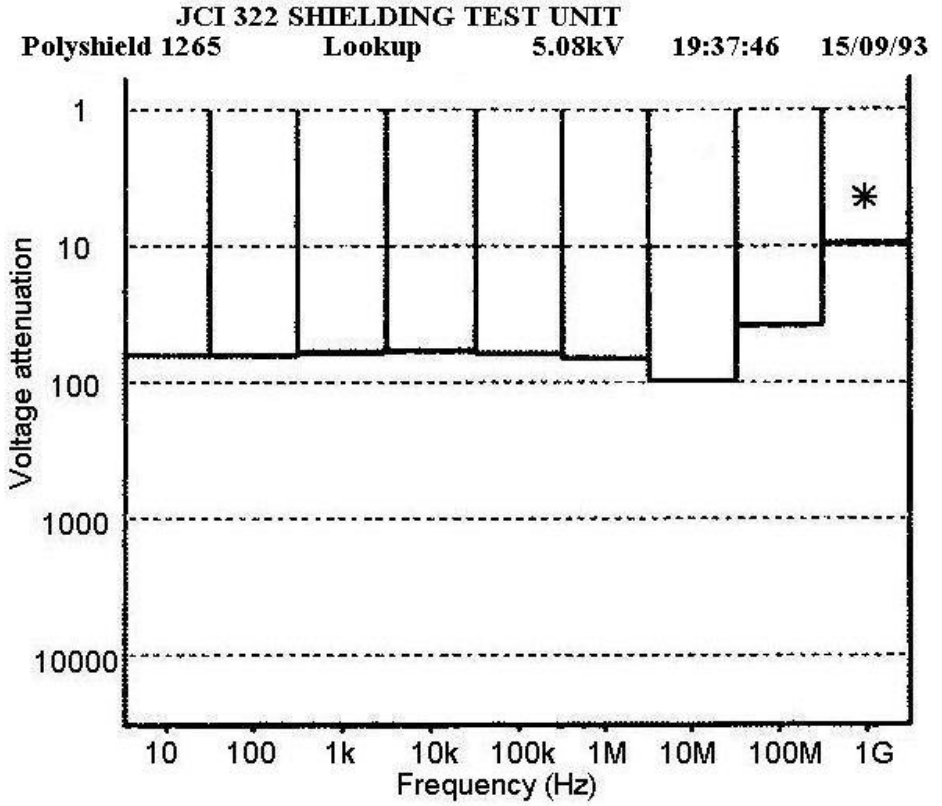
Measuring shielding as a function of frequency enables performance to be matched to application

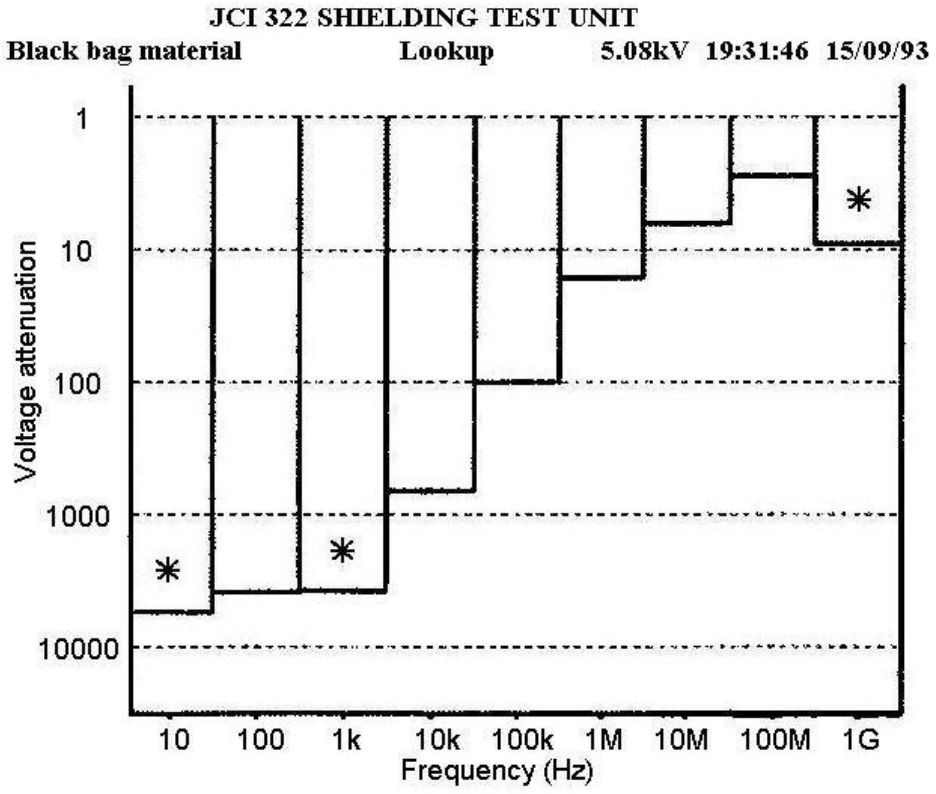




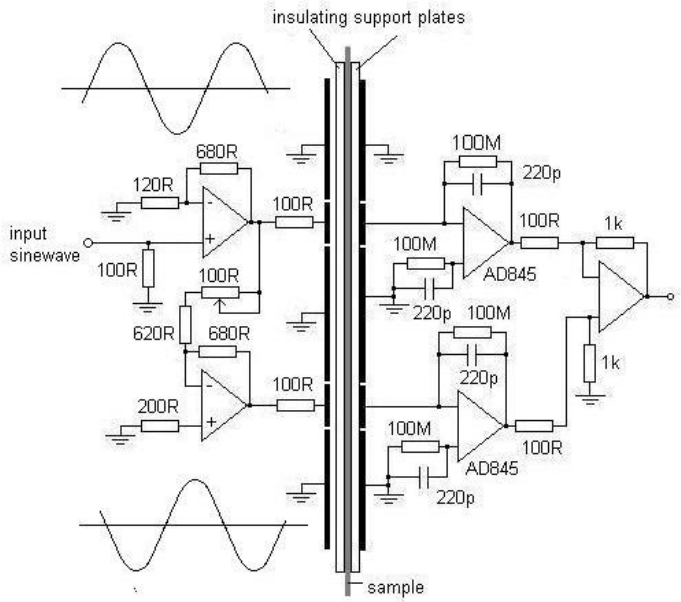


Practical arrangement to measure performance 10Hz to 1GHz

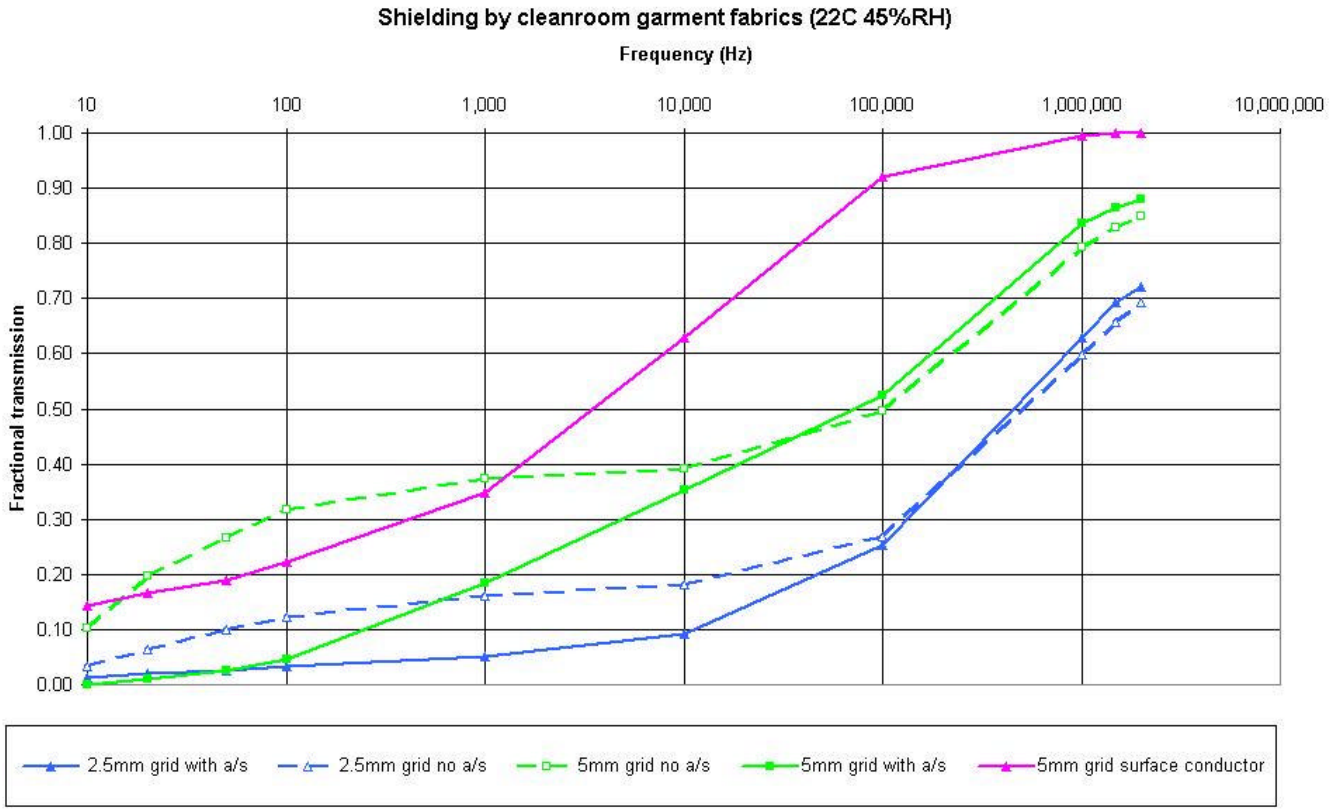




Examples of variation with frequency



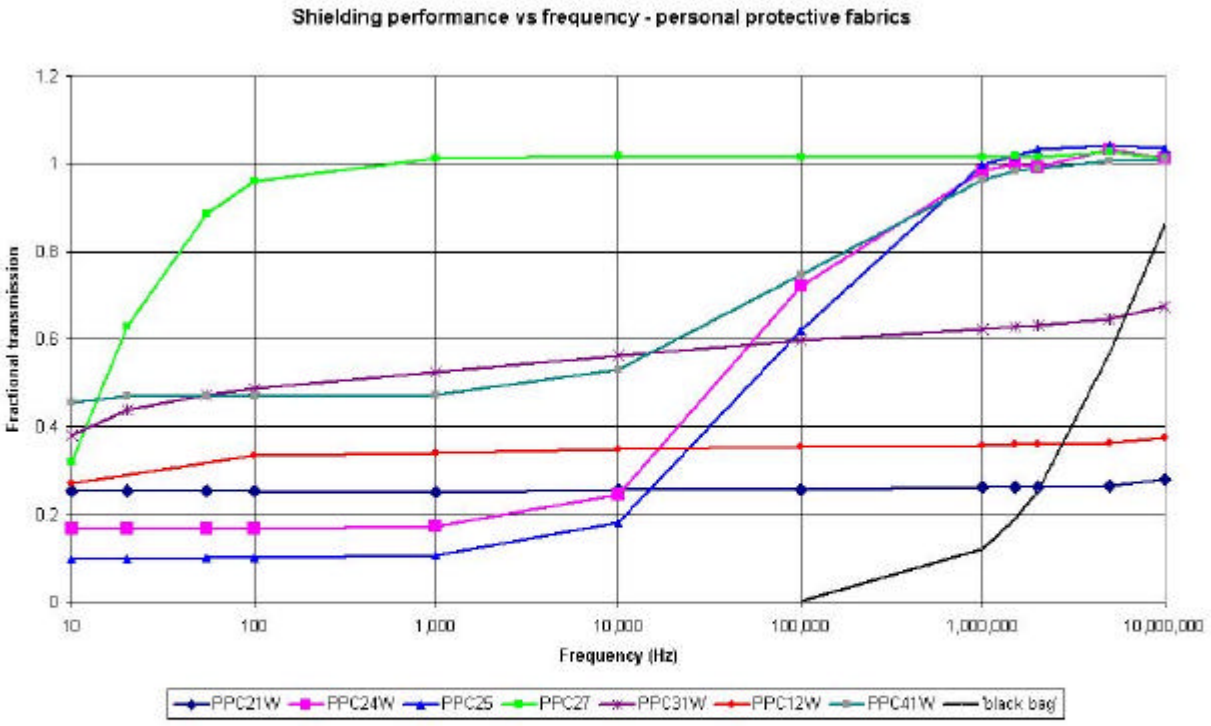
Simple arrangement for measurements 10Hz to 10MHz



Note:

- *reduced transmission with closer spacing of conductive threads*

- *reduced transmission below 10kHz with antistat*



	Conductive component	
PPC12	*Stainless steel blend*	*Washed*
PPC21	*1% Stainless steel blend*	*Washed*
PPC24	*3% carbon core blend*	*Washed*
PPC25	*3% carbon core blend*	
PPC27	*Antistatic coating*	
PPC31	*1% metal fibre blend*	*Washed*
PPC41	*5 mm carbon core grid*	
Black bag	*carbon loaded*	

CONCLUSIONS

‘Static’ causes variety of problems for packaging

Best way to avoid problems is to ensure materials are suitable.

This requires:

?? *measurements*

?? *ways to modify materials*