Comparing the Dielectric Strength of different materials.

The two major considerations when comparing the published dielectric strength of different materials are:

a) the thickness of the test specimen
b) the test temperature.

The test results can be drastically different if these two conditions are not identical for the products being compared.

Normally the standard test calls for a specimen thickness of 1/8" (125 mils) tested at room temperature (22^0C) and the result is expressed in volts/mil. Occasionally it is necessary to generate application specific test results at some other temperature and these are the results shown on technical data sheets. The following rules of thumb are applicable to Epoxy and Polyurethane compounds:

1. Unfilled materials (materials that do not contain any fillers such as silica) almost always are higher in dielectric strength than those containing fillers.
2. A thinner test specimen will yield higher results and visa versa.
3. The higher the test temperature the lower the volts/mil.
4. Rigid materials yield higher volts/mil than softer products.

There are certain cases, such as with very low viscosity impregnating compounds or coating materials where standard the test method because it is impossible to cast 125 mil test specimens with good integrity. In these cases copper specimens are coated to a 1mill thickness for the test.

As another rule of thumb, the average dielectric strength for epoxies and polyurethanes are as follows:

1. Flexible materials typically fall between 350 - 400 volts/mil.
2. Rigid materials are usually between 450 - 500 volts/mil.

There is a method to estimate the dielectric strength for any thickness of the same material provided that an accurate dielectric strength is known along with specimen thickness that was used to obtain it. This can be done using the formula developed by Carl J. Tautscher as follows;

$$VxPm = Vpm \frac{\sqrt{t}}{\sqrt{tx}}$$

Where Vpm = Dielectric strength at thickness t in mils.
Vxpm = Dielectric strength at thickness tx in mils.
t = The thickness of the known test specimen.
tx = The thickness in mils of the insulation for which the strength is to be calculated.

In general, it is imperative that both the sample thickness and the test temperature is known for each product in order to compare the dielectric strengths in a meaningful way.