Answer on Question #59732-Physics-Electromagnetism

The dielectric strength of polyethylene (i.e. the electric field value above which a spark will jump through the material) is about 1.8 × 10 5 V / cm. The dielectric constant for polyethylene is 2.3. If polyethylene fills the gap between two metal plates 0.20 cm apart, how large a voltage difference can be applied to the two plates before break down?

Solution

The electric field with presence of dielectric is

$$E = \frac{E_0}{k}.$$

Maximal voltage difference is

$$V = E_0 d = k E_{max} d = 2.3 \cdot 1.8 \cdot 10^5 \frac{V}{cm} \cdot 0.20 \text{ cm} = 83 \text{ kV}.$$