Parallel-plate capacitor: electric field

Physics 225 – Background wiki

Ideal parallel plate capacitor

A parallel-plate capacitor has plates of area A separated by a distance d (for an ideal model capacitor, the gap d is much smaller than the dimensions of the plates).

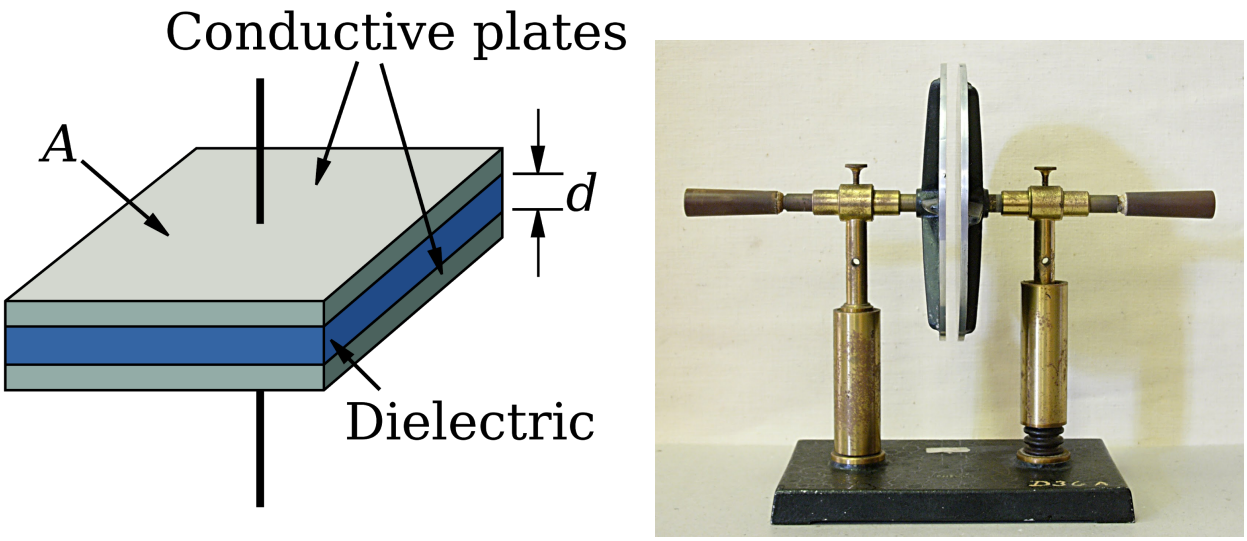

Figure 1: Parallel-plate capacitor image source: https://en.wikipedia.org/wiki/Capacitor

For an ideal parallel-plate capacitor, the electric field outside the plates is zero. In between the plates the field is uniform, and points directly from the positive to the negative plate. Its magnitude is given by equation 1.

$$E = \frac{\eta}{\kappa\varepsilon_0} \qquad \text{(Equation 1)}$$

In Equation 1:

- κ is the relative permittivity of the material between the plates,
- ε_0 is the permittivity of free space, $8.854 * 10^{-12}\ \frac{F}{m}$
- η is the surface charge density on the plates

Non-ideal parallel plate capacitor

In a non- ideal parallel-plate capacitor, the gap is of comparable size to the dimensions of the plates. In this case there are non-zero (and non-uniform) fringing electric fields in the region outside the gap between the plates. The closer the capacitor resembles the ideal case, the smaller these fields will be.

Credits

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