Capacitor Principles

Copyright (c) 2017 Young W. Lim.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

Please send corrections (or suggestions) to youngwlim@hotmail.com.

This document was produced by using OpenOffice and Octave.

Dielectric Model



Electric field interaction with an atom under the classical dielectric model.

https://upload.wikimedia.org/wikipedia/commons/thumb/f/fb/Dielectric_model.svg/800px-Dielectric_model.svg.png

Dielectric Polarization



Capacitor Principles

Electric Dipole



A water molecule, a commonly used example of polarity. Two charges are present with a negative charge in the middle (red shade), and a positive charge at the ends (blue shade).



Capacitor Principles

5

Surface Charge



A uniform array of identical dipoles is equivalent to a surface charge.

6

Conductor : Silver

Material	o [O·m] at 20°C	σ [<u>S</u>] at 20°C
Hateria	p [11 m] at 20 C	"m' at 20 C
Silver, Ag	1.59×10^{-8}	6.30×10^{7}
Copper, Cu	1.68×10^{-8}	5.96×10^{7}
Aluminum, Al	2.82×10^{-8}	3.50 × 10 ⁷



https://commons.wikimedia.org/wiki/File:Electron_shell_047_Silver_-_no_label.svg

7

Capacitor Principles

Conductor : Copper



Material	ρ [Ω·m] at 20°C	$\sigma \left[\frac{S}{m}\right]$ at 20°C
Silver, Ag	1.59×10^{-8}	6.30×10^{7}
Copper, Cu	1.68×10^{-8}	5.96×10^{7}
Aluminum, Al	2.82×10^{-8}	3.50×10^{7}

https://upload.wikimedia.org/wikipedia/commons/thumb/f/f7/Electron_shell_029_ Copper_-_no_label.svg/480px-Electron_shell_029_Copper_-_no_label.svg.png

8

Capacitor Principles

Conductor : Aluminium

Material	ρ [Ω·m] at 20°C	σ [<u>s</u>] at 20°C
Silver, Ag	1.59×10^{-8}	6.30 × 10 ⁷
Copper, Cu	1.68×10^{-8}	5.96×10^{7}
Aluminum, Al	2.82×10^{-8}	3.50×10^{7}

https://upload.wikimedia.org/wikipedia/commons/thumb/f/f7/Electron_shell_029_
Copperno_label.svg/480px-Electron_shell_029_Copperno_label.svg.png

9

Capacitor Principles

Young Won Lim 05/01/2017

Metallic Bonding and Structure

The atoms of metallic substances are typically arranged in one of three common crystal structures, namely body-centered cubic (bcc), face-centered cubic (fcc), and hexagonal close-packed (hcp).

In bcc, each atom is positioned at the center of a cube of eight others.

In fcc and hcp, each atom is surrounded by twelve others, but the stacking of the layers differs.

Some metals adopt different structures depending on the temperature.

https://en.wikipedia.org/wiki/Metal

hcp and fcc close-packing of spheres



I leads V by 90°





I leads V by 90°

References

- [1] http://en.wikipedia.org/
- [2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003