Capacitor Principles

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

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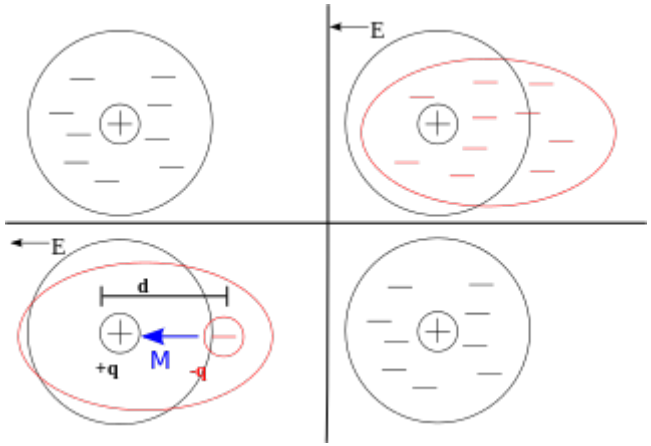
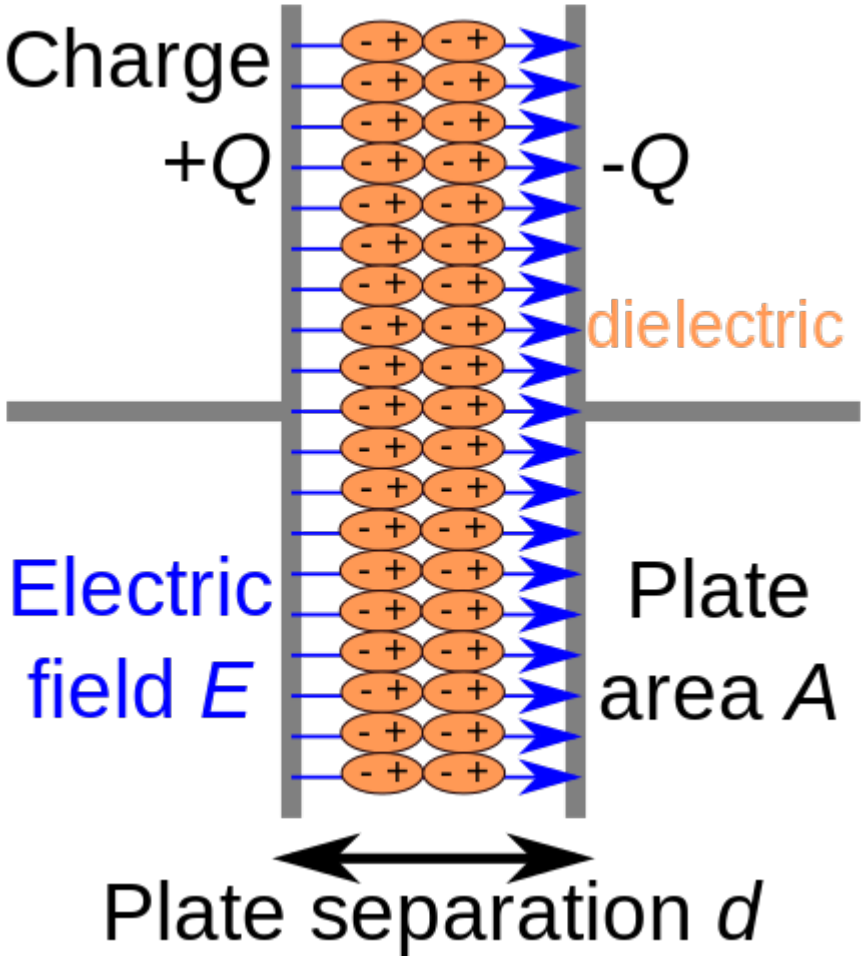
Dielectric Model



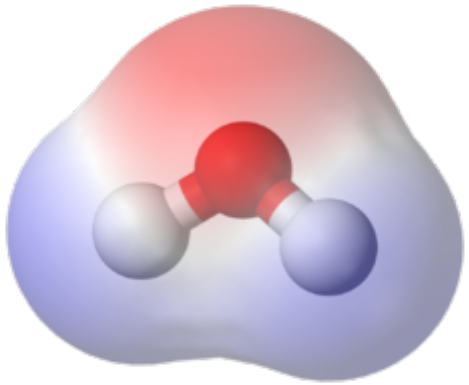
Electric field interaction with an atom under the classical dielectric model.

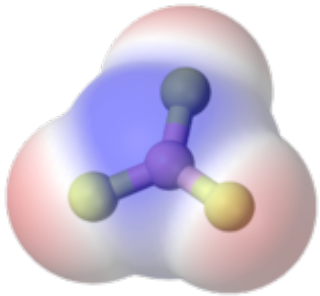
https://upload.wikimedia.org/wikipedia/commons/thumb/f/fb/Dielectric_model.svg/800px-Dielectric_model.svg.png

Dielectric Polarization



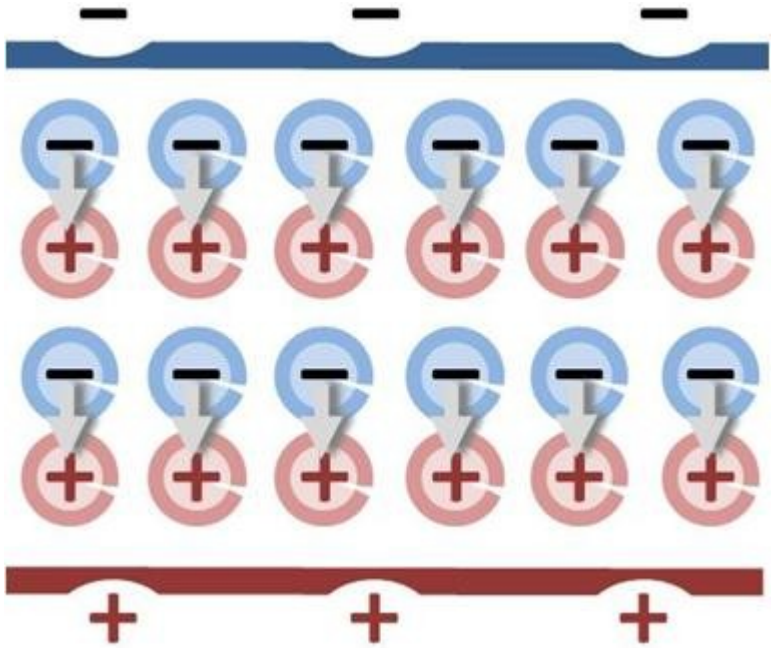
Electric Dipole





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).

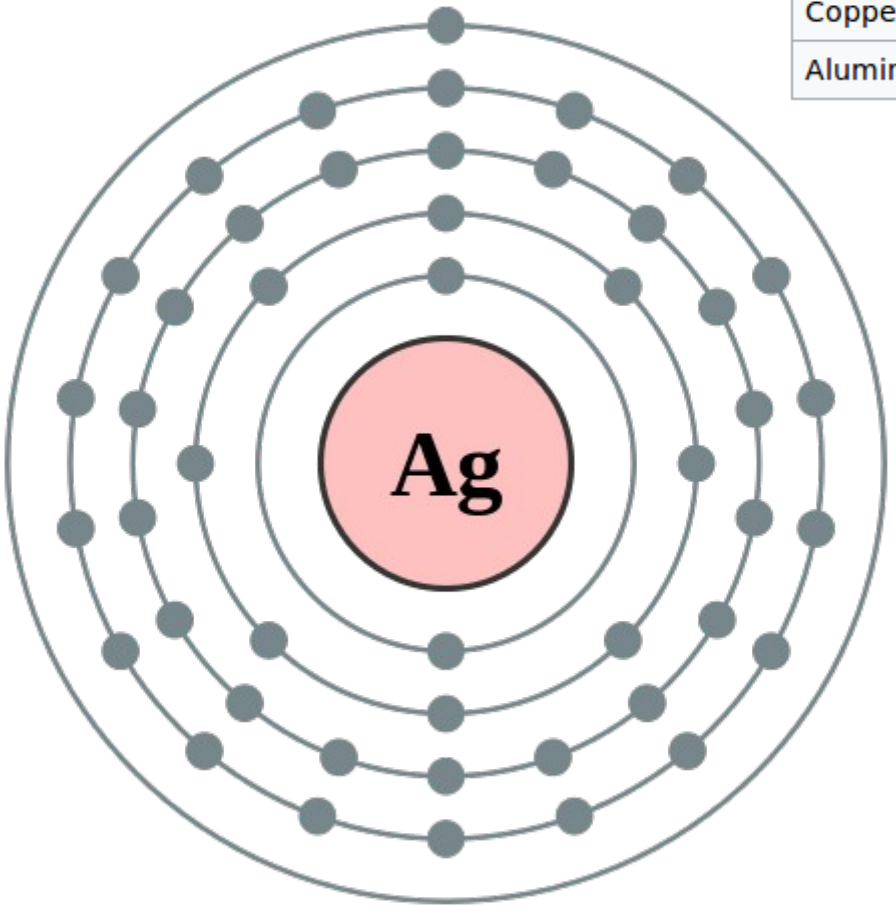
Surface Charge



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

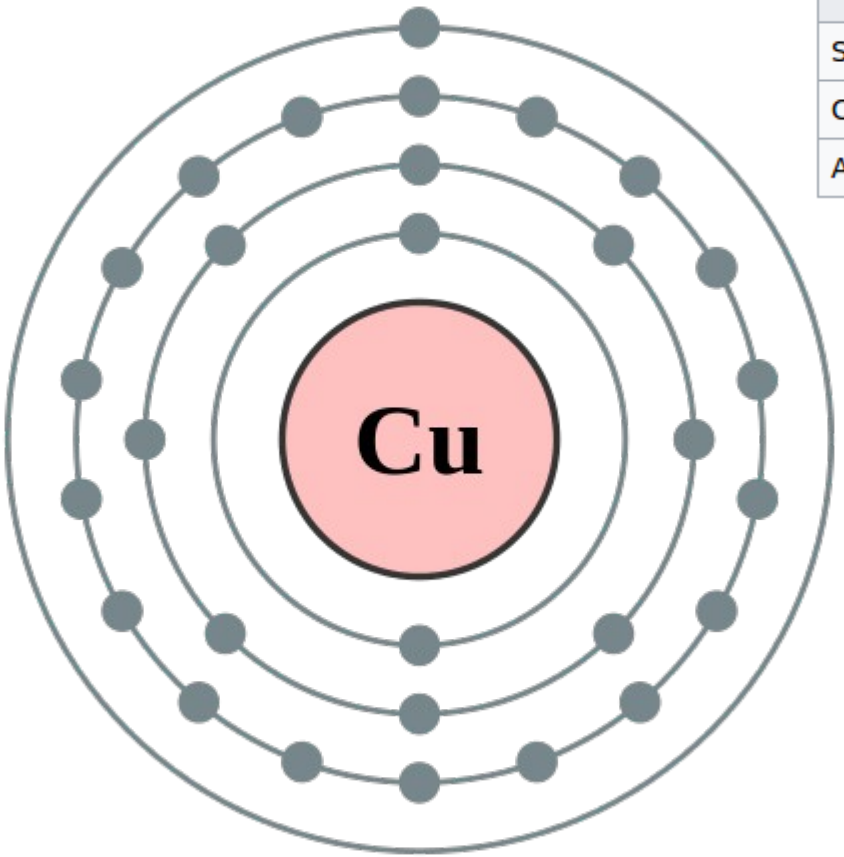
Conductor : Silver

Material	ρ [Ω·m] at 20°C	σ [$\frac{S}{m}$] 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

Conductor : Copper



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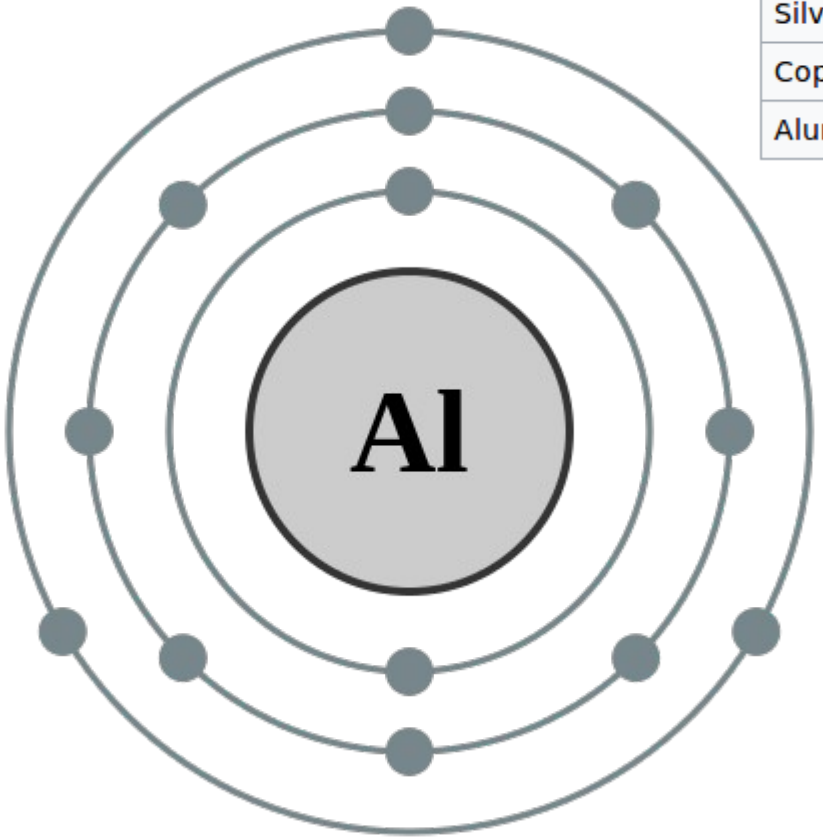
https://upload.wikimedia.org/wikipedia/commons/thumb/f/f7/Electron_shell_029_Copper_-_no_label.svg/480px-Electron_shell_029_Copper_-_no_label.svg.png

Conductor : Aluminium



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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

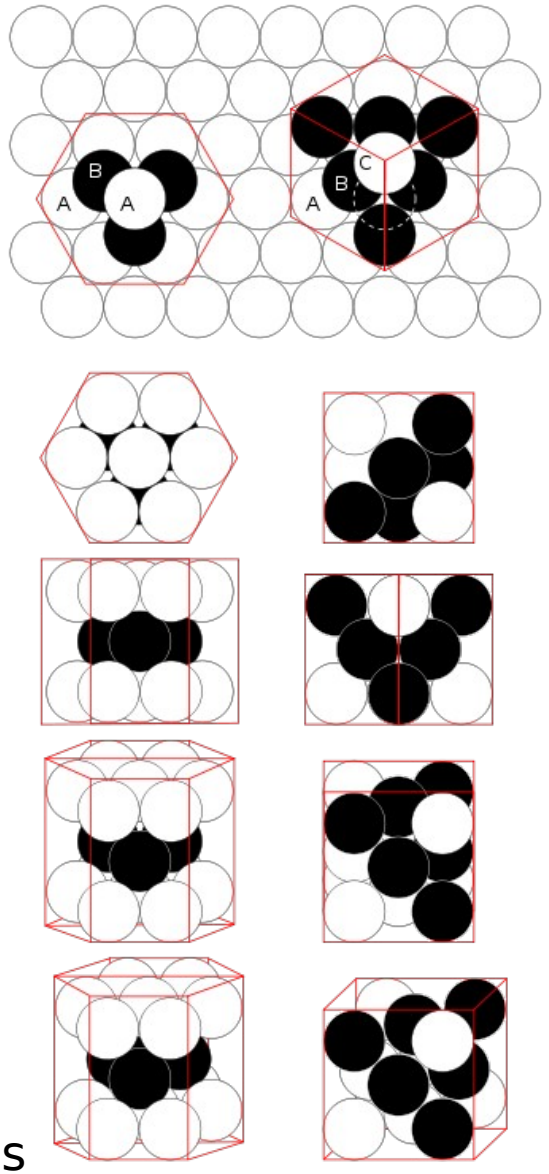
Metallic Bonding and Structure

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.

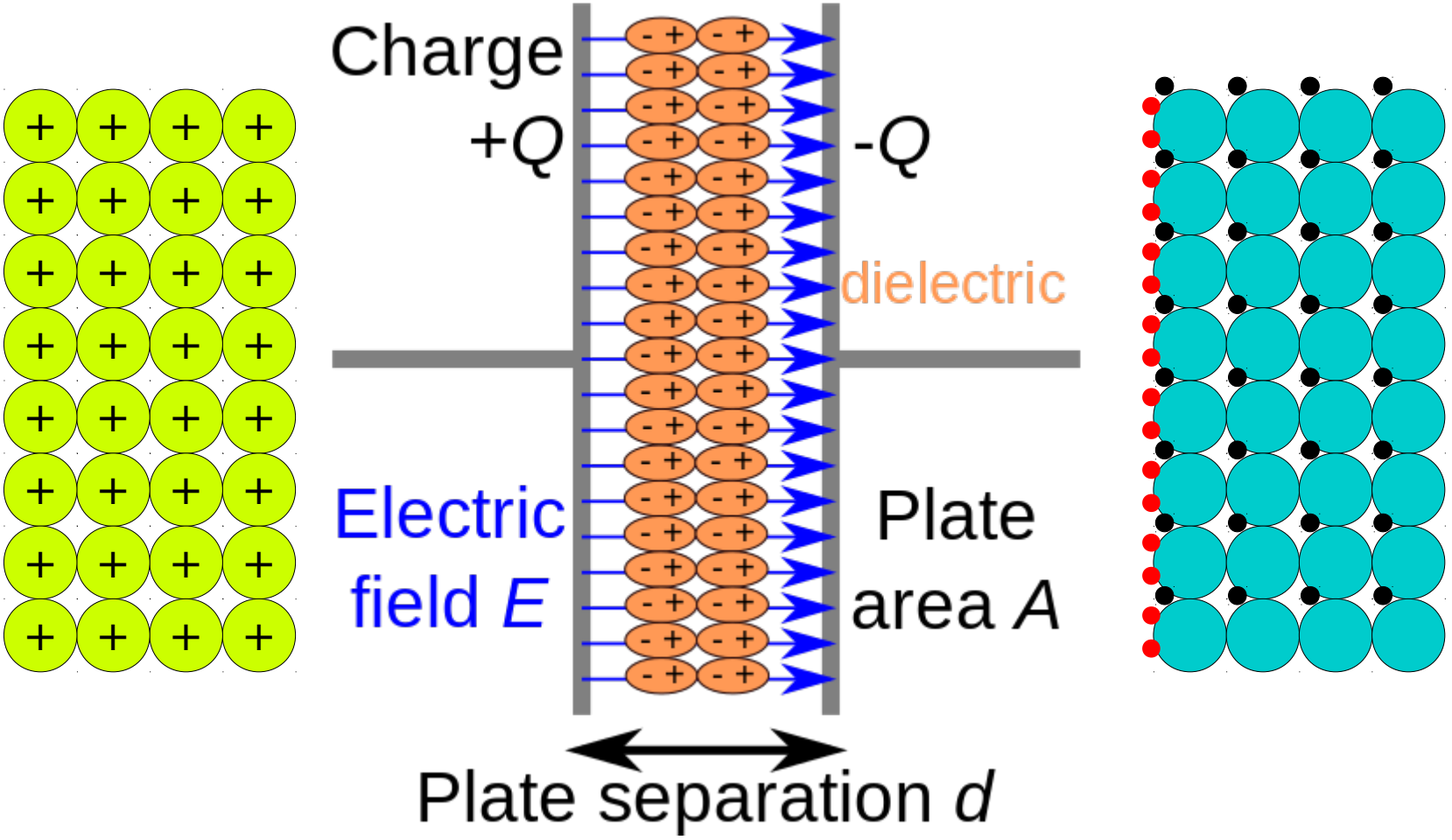
Some metals adopt different structures depending on the temperature.



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