



**MATERIALS SCIENCE  
& ENGINEERING**  
TEXAS A&M UNIVERSITY

# Introduction to Materials Science & Engineering

## Thermal Conductivity

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# Thermal Conductivity

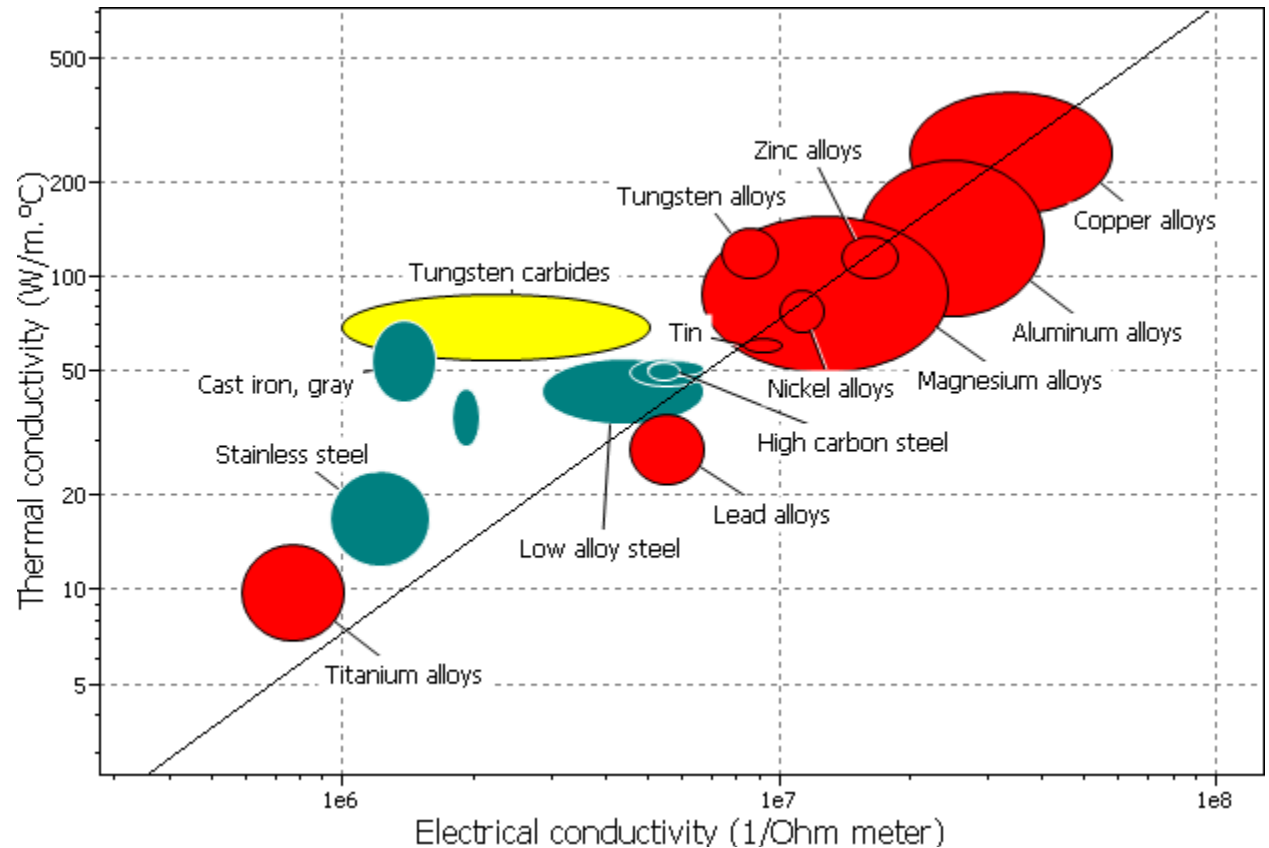
$$q_x = -k \frac{dT}{dx}$$

$$\frac{\Delta Q}{\Delta t} = -kA \frac{\Delta T}{\Delta x}$$

# Thermal Conductivity: Electron/Phonon

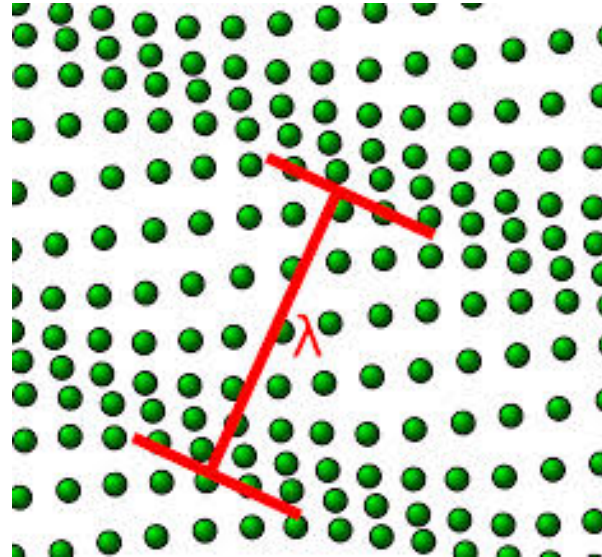
$$q_x = -k \frac{dT}{dx}$$

$$\frac{\kappa}{\sigma} = LT$$

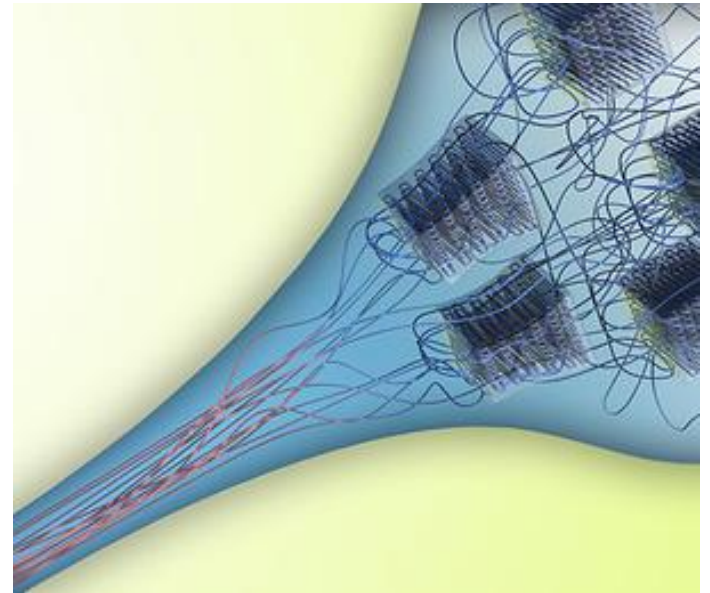
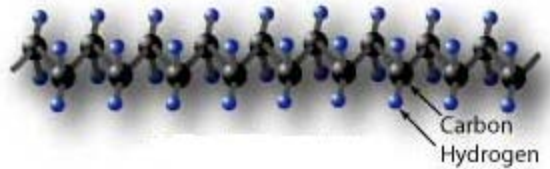


# Thermal Conductivity: Electron/Phonon

$$q_x = -k \frac{dT}{dx}$$



# Thermal Conductivity Example: Polymers



<http://www.shenlabcmu.net/>

# Summary

- Thermal conductivity: 2 components
  - Electronic contribution
  - Phonon contribution
- Wiedermann-Franz Law
- Stiff/strong bonds lead to greater phonon thermal conductivity.