



Structure Property Correlation

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Why is important to study
structure of a material?

How to install steel tire on wooden wheel?

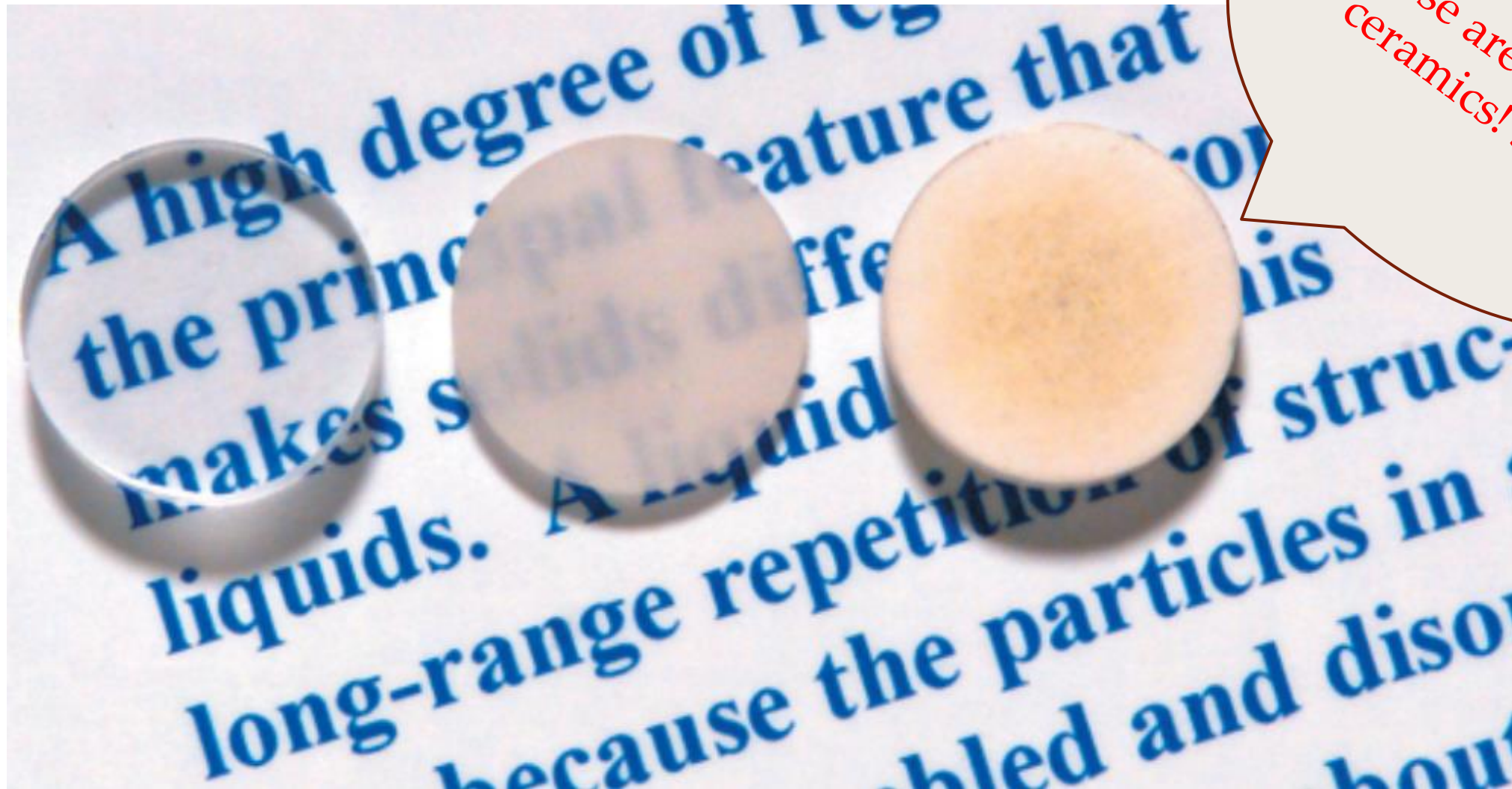
3

By processing the metal wheel? HOW?



Structure-property correlations

Can you identify these materials?



These are all Al_2O_3 ceramics! Same!

Opacity can be altered by processing as per requirement

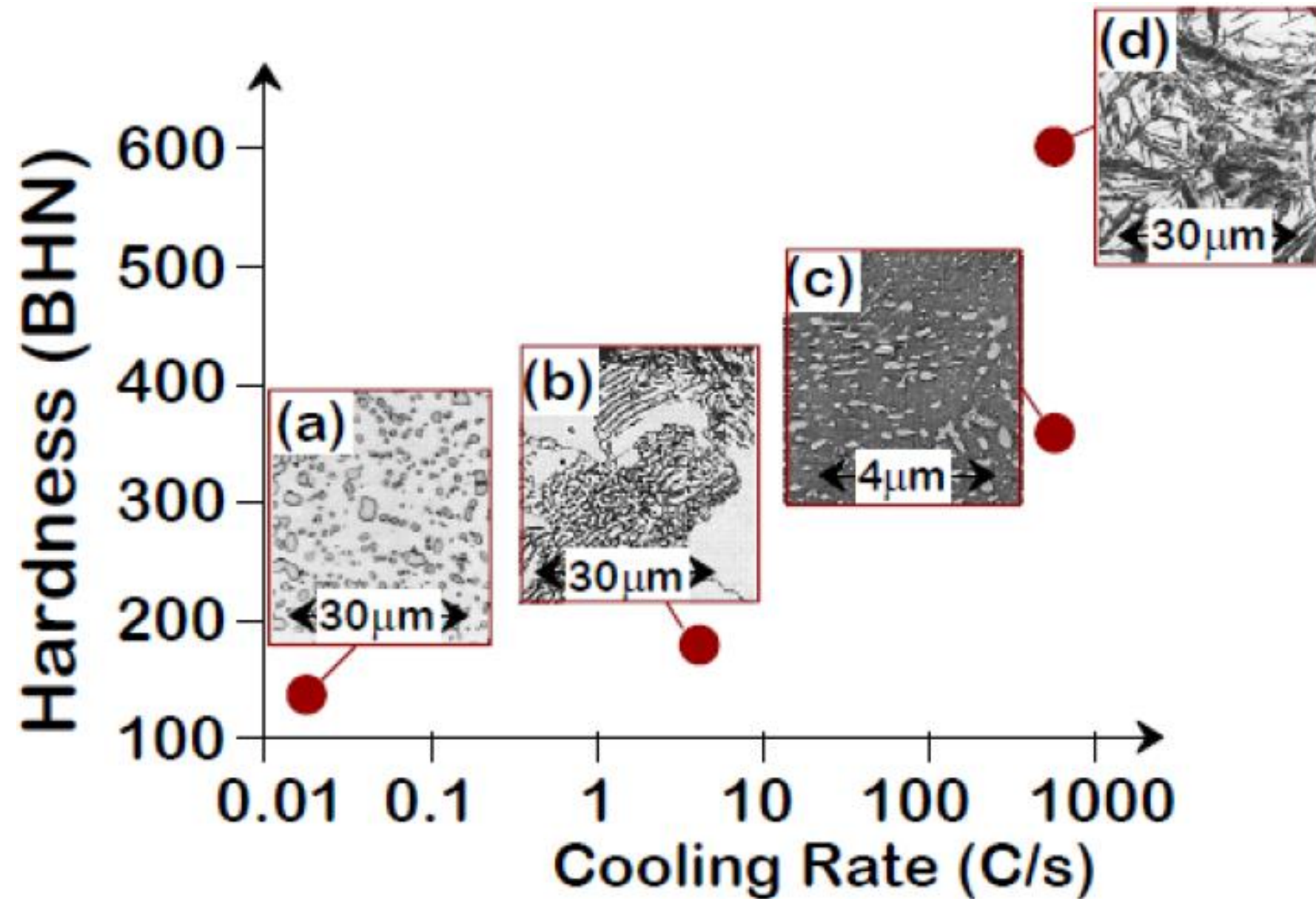
Structure-property correlations

Why there is a huge difference in conductivity, hardness?



Structure-property correlations

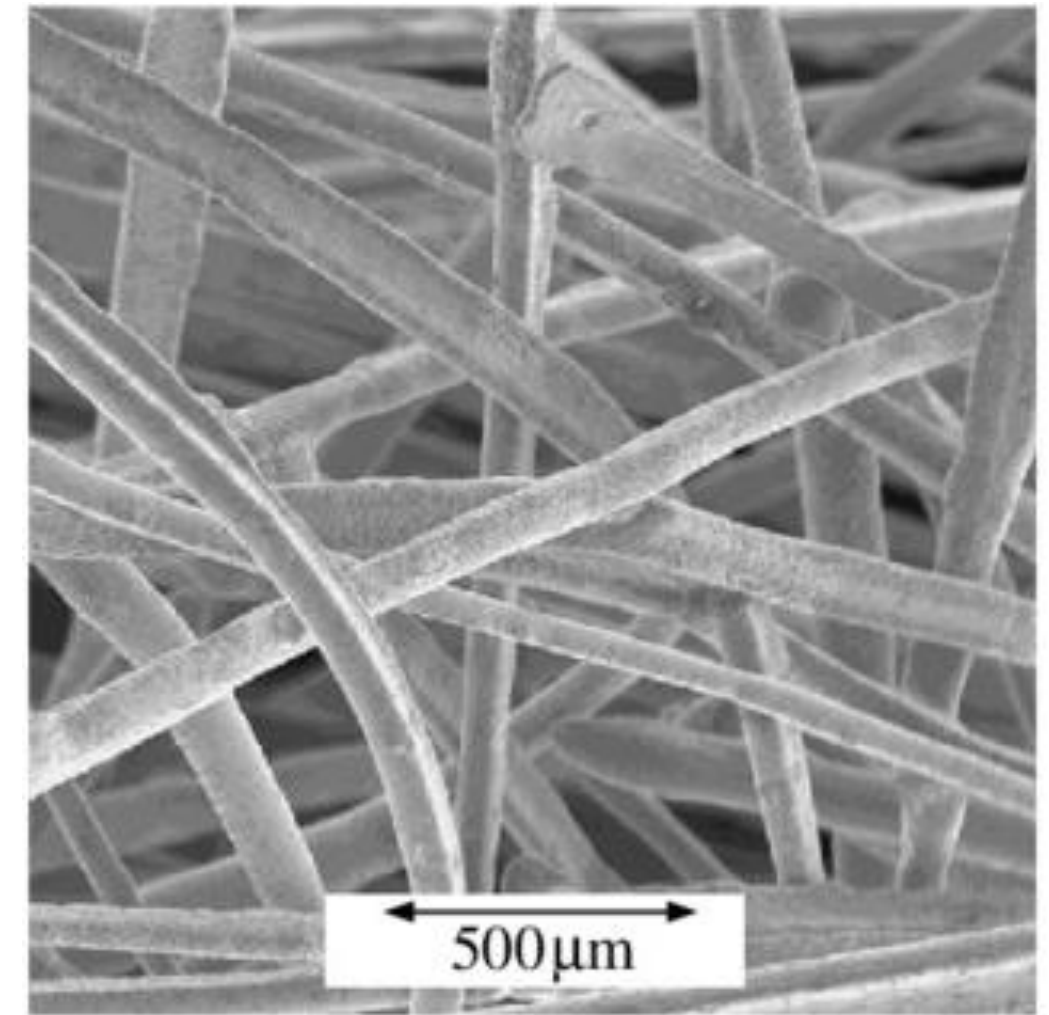
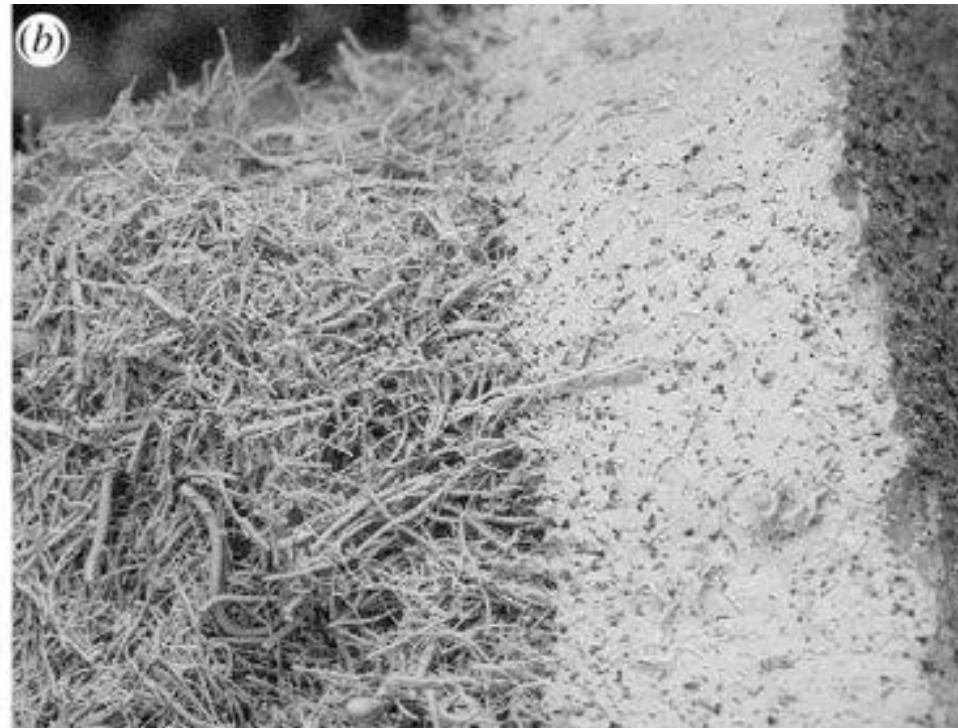
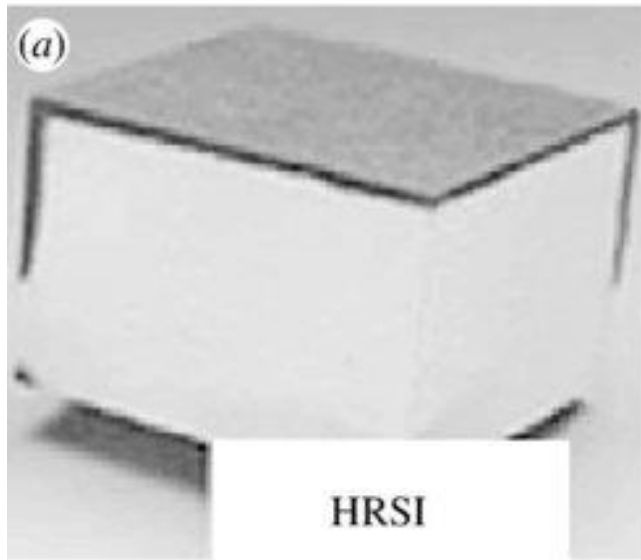
Hardness vs Structure of Stainless Steel



Hardness can be fine tuned by processing

Structure-property correlations

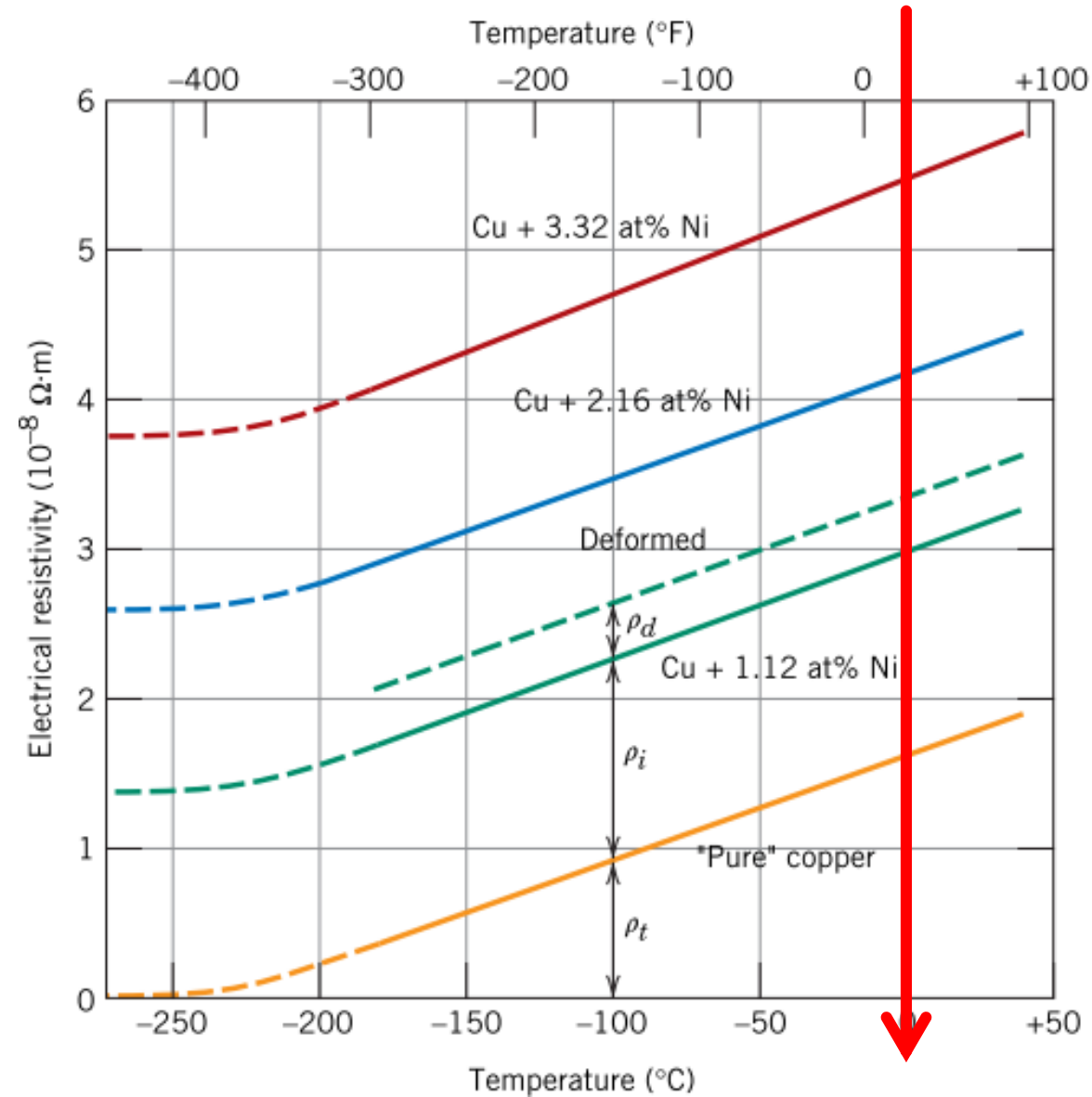
Microstructure of silica tile used on outer surface of space shuttle



Porous structure is more thermally insulating than dense? Why?

Structure-property correlations

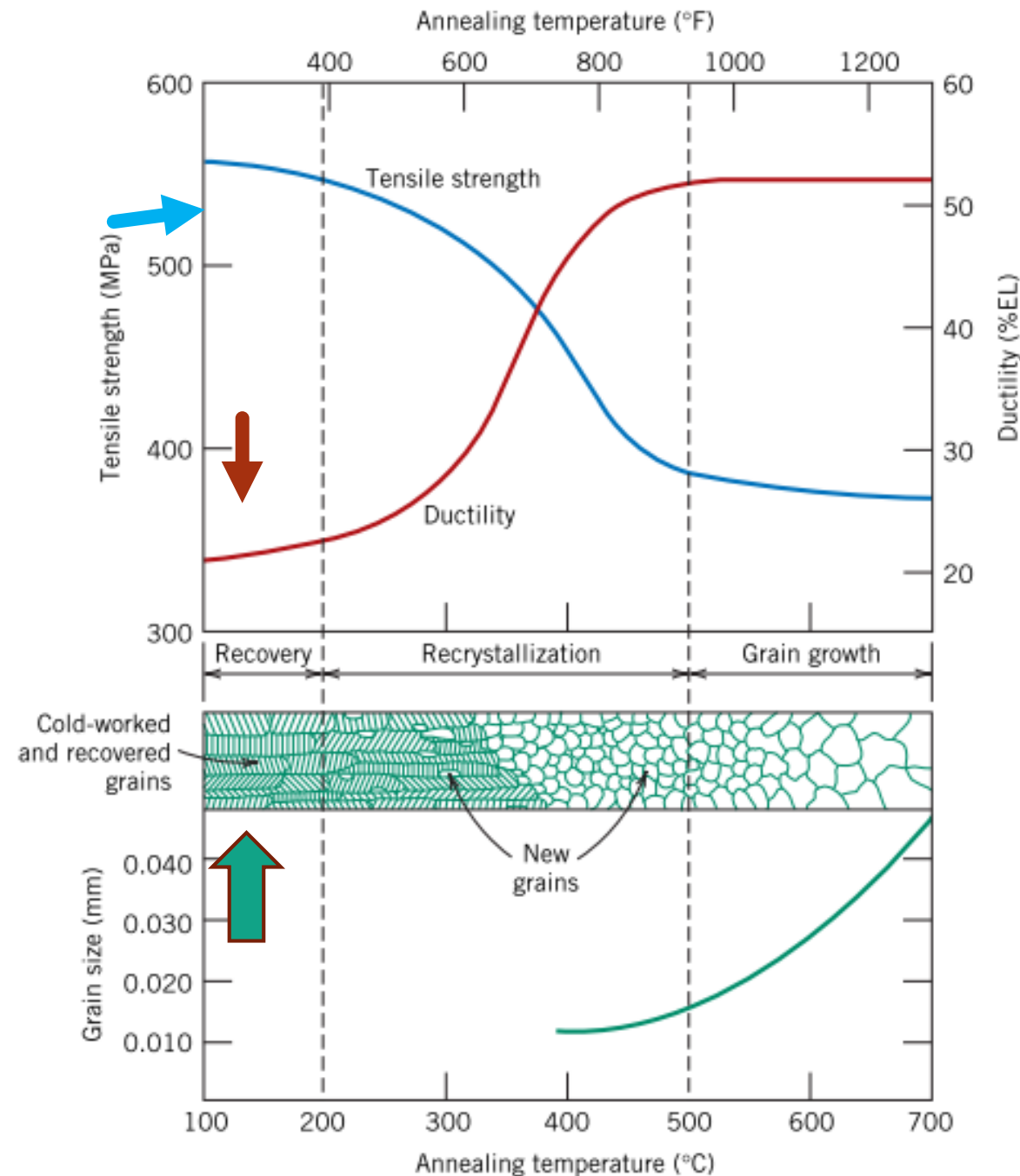
Electrical resistivity vs Temperature for Cu



Resistivity can be fine tuned by processing

Structure-property correlations

Tensile strength and ductility vs Grain size



1. We can change the property of any material by changing its structure.
2. Structure-property relationship is important in understanding the behavior of the material.

1. Name the different mechanical, thermal, electrical, magnetic, chemical, optical and physical properties of materials.
2. Mention different technological properties of metals and alloys and explain them.
3. Give five examples and applications of each of metal, alloy, ceramic, polymer, composite and electronic materials.
4. Differentiate between grain and grain boundary. Find some good micrographs showing grain and grain boundary clearly.
5. Identify the type(s) of bonding(s) present in the following materials: Graphite, Bakelite, Glass, SiC, CdS, AgCl, MgO, Al₂O₃, Clay, Germanium, Brass, ZnO and also give their respective applications.
6. What is the difference between macrostructure, microstructure and substructure of the material?

7. Find at least two optical microscope and SEM images of pure metals, alloys and composite materials.
8. What is the difference between an element and compound? List five elements which are metals, non-metals and metalloids.
9. Explain the difference between an amorphous and crystalline material with suitable example. Show a microstructure of any amorphous material.
10. What are composite, ceramics and alloys? Contrast between mixture and compound.
11. What do you understand by structure sensitive and structure insensitive properties of materials? Give at least three examples of each.
12. Which technique can be used to determine the substructure and crystal structure of materials? Give their resolution powers.
13. Write down the physical, electrical, mechanical properties of at least five polymeric materials.