Texture and Anisotroy

Part I:

Chapter 1. Introduction

Introduction to Texture

Why should we understand texture?

Crystallographic orientation

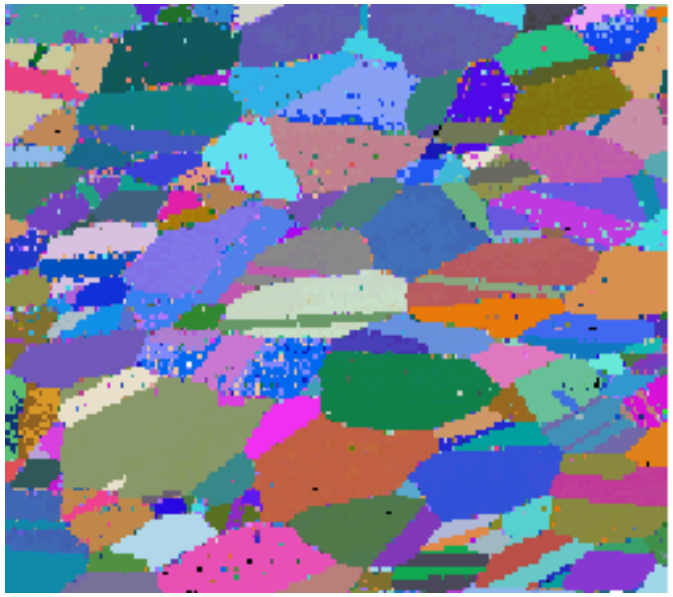
Crystallographic orientation (called orientation): the atomic planes in a volume of crystal are positioned relative to a fixed reference

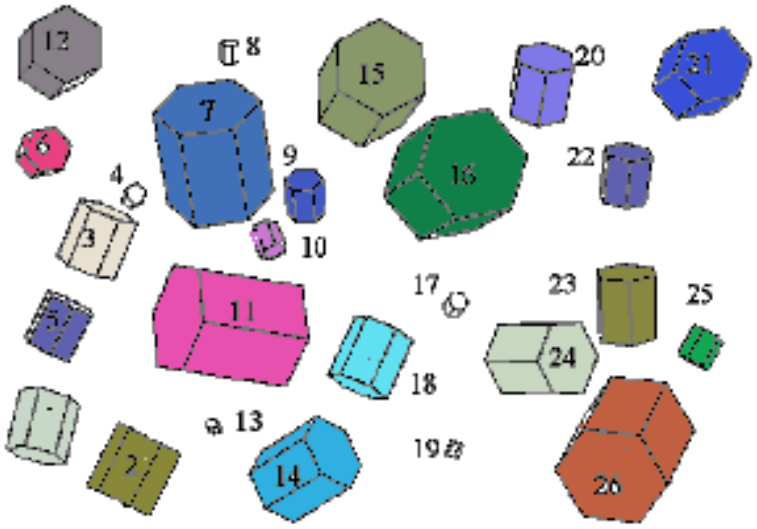
Preferred orientation (texture): is important because many material properties is depend on texture, such as

Young's modulus, Poisson's ratio, strength, ductility, toughness, magnetic permeability, electrical conductivity, thermal expansion

Definition of Texture

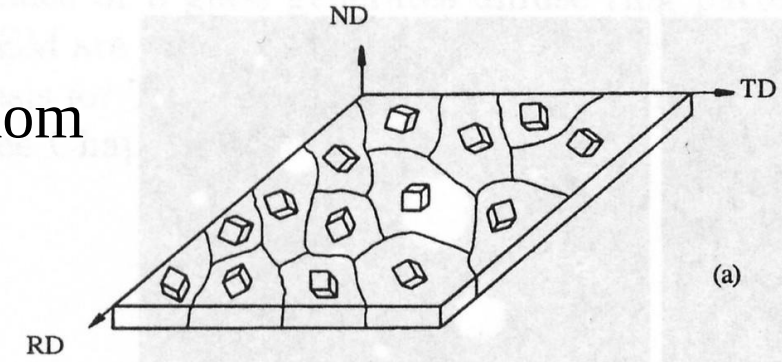
- ***Crystallographic texture*** is defined as the preferred alignment of the crystallographic orientations in a polycrystalline medium.

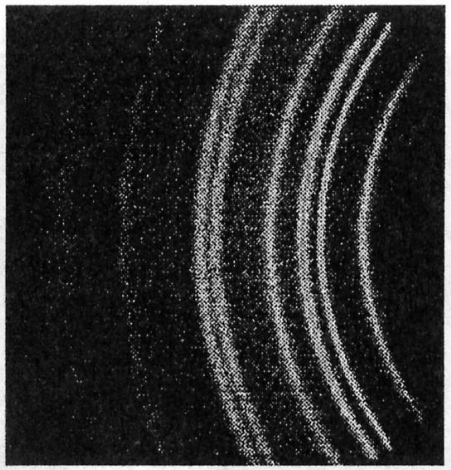


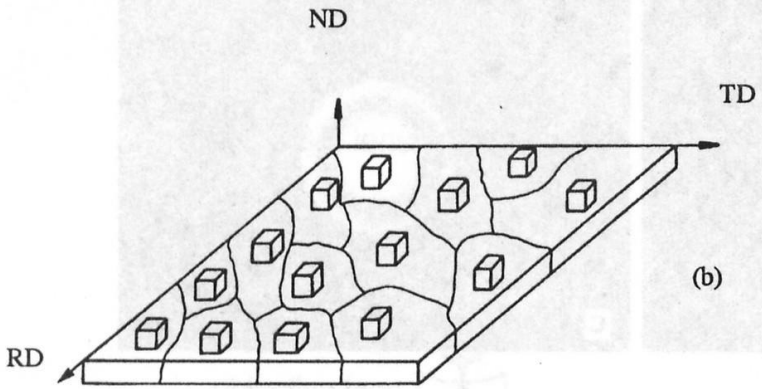


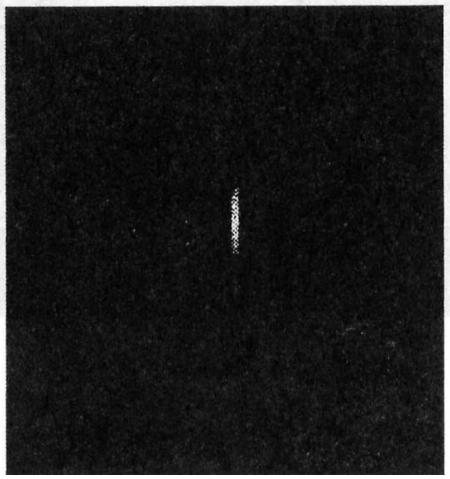
Preferred Orientation

Random

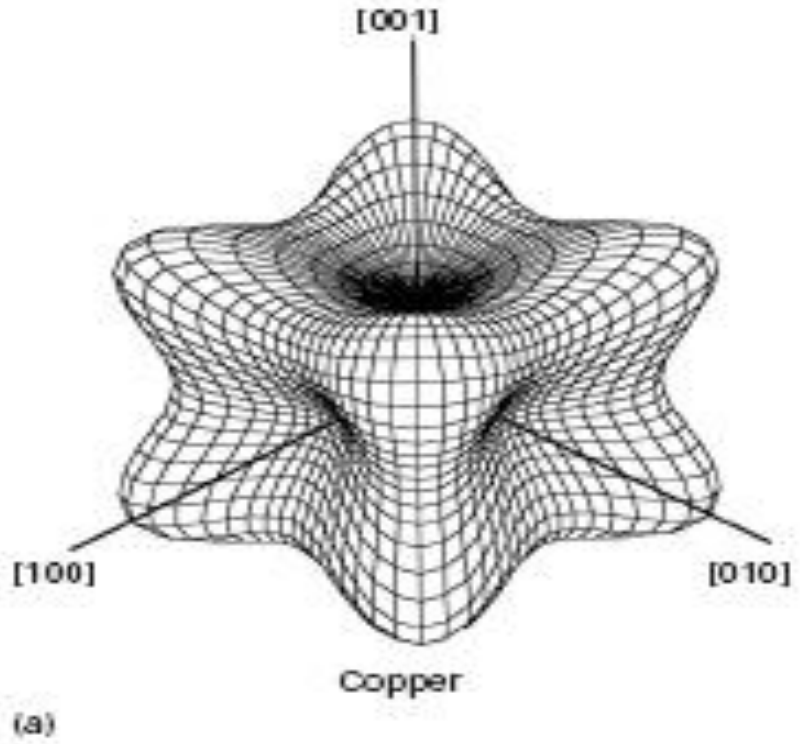








Young's modulus of single crystal Cu



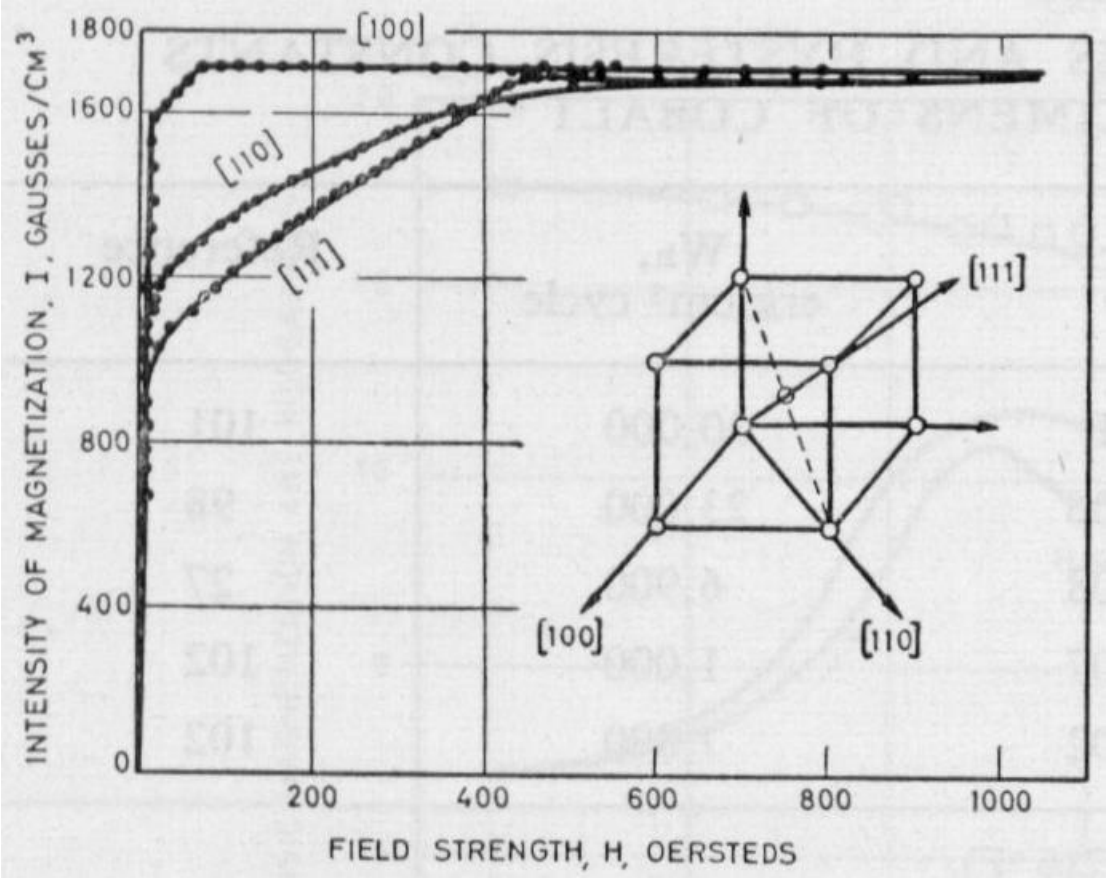
$$E_{100} = 66GPa$$

$$E_{110} = 130GPa$$

$$E_{111} = 191GPa$$

Anisotropy of magnetization in Iron

Electrical Steel: is a magnetically soft material that is used as a core of power generation and distribution equipment.



Fe (bcc)

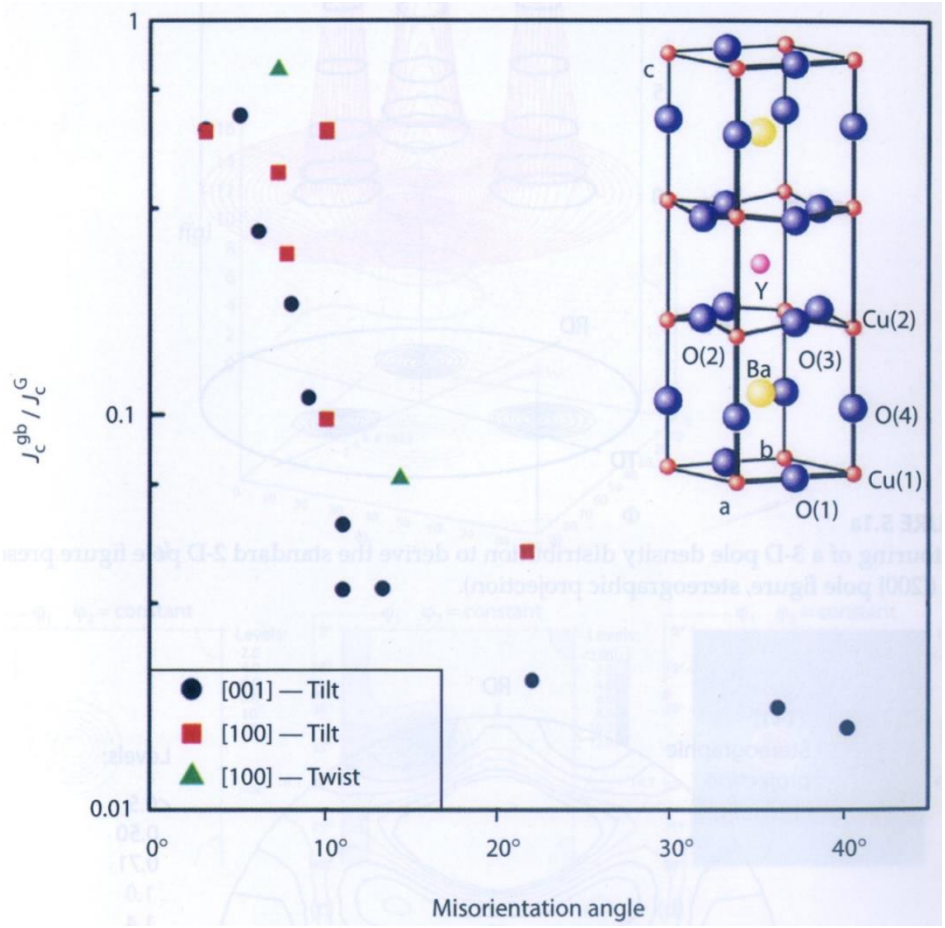
Transformer and Texture

Electrical Steel: is a magnetically soft material that is used as a core of power generation and distribution equipment.

GO silicon steel has a texture called Goss{110}<001>, in which the crystals are arranged in the direction of the easiest magnetization (direção [001] – cube's adge), parallel to the rolling direction and to the cube's diagonal plan (110) and parallel to the plate's plan. This kind of structure turns the GO steel into a material with excellent magnetic characteristics in the rolling direction and makes it suitable to the use in static cores where the magnetic flow is similar to the rolling direction, such as the transformers.

Earing of deep-drawn cup from Al sheet and anisotropy

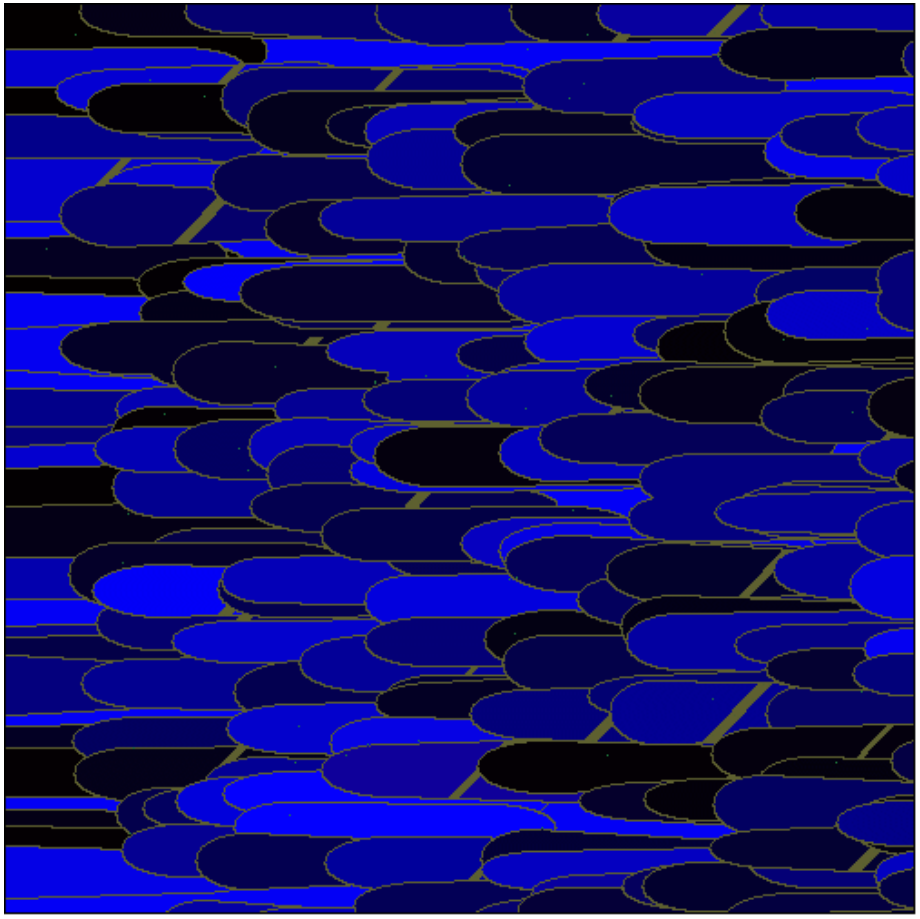
Superconductors and Anistropy

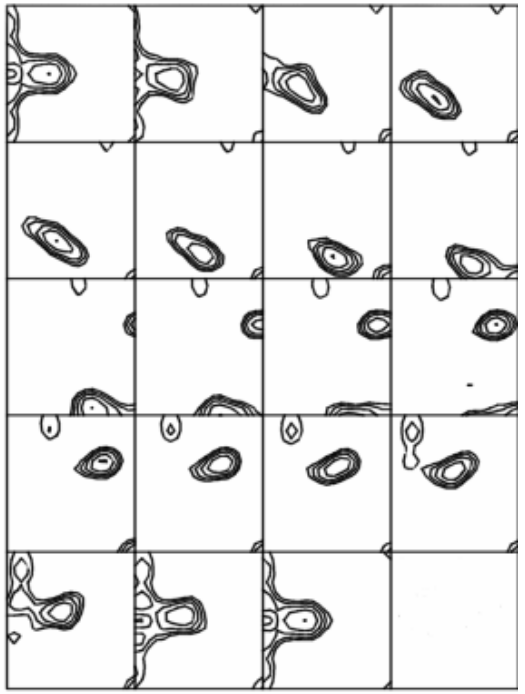


Jc of YBa2Cu3O7-x depends on the degree of texturing and on the type of grain boundaries.

FIGURE 1.4
(See color insert following page 240.) Current transmission, that is, the ratio of intergrain (gb) and intragrain (G) critical current densities J_c across grain boundaries in YBCO superconductors as a function of misorientation angle (at 5 K). High superconducting current transmission requires maximum fraction of low-angle grain boundaries, that is, a very sharp texture. (Courtesy of B. Obst.)

Texture and Anisotropy





From IMM of RWTH-Aachen

Applications of texture

- Technological control of material processing
- Understanding of fundamental materials science and geological sciences