3.40J / 22.71J
Modern Physical Metallurgy

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Lecture 2: Deformation of single crystals, Part I

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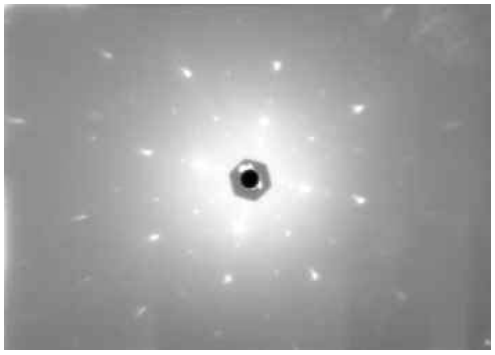
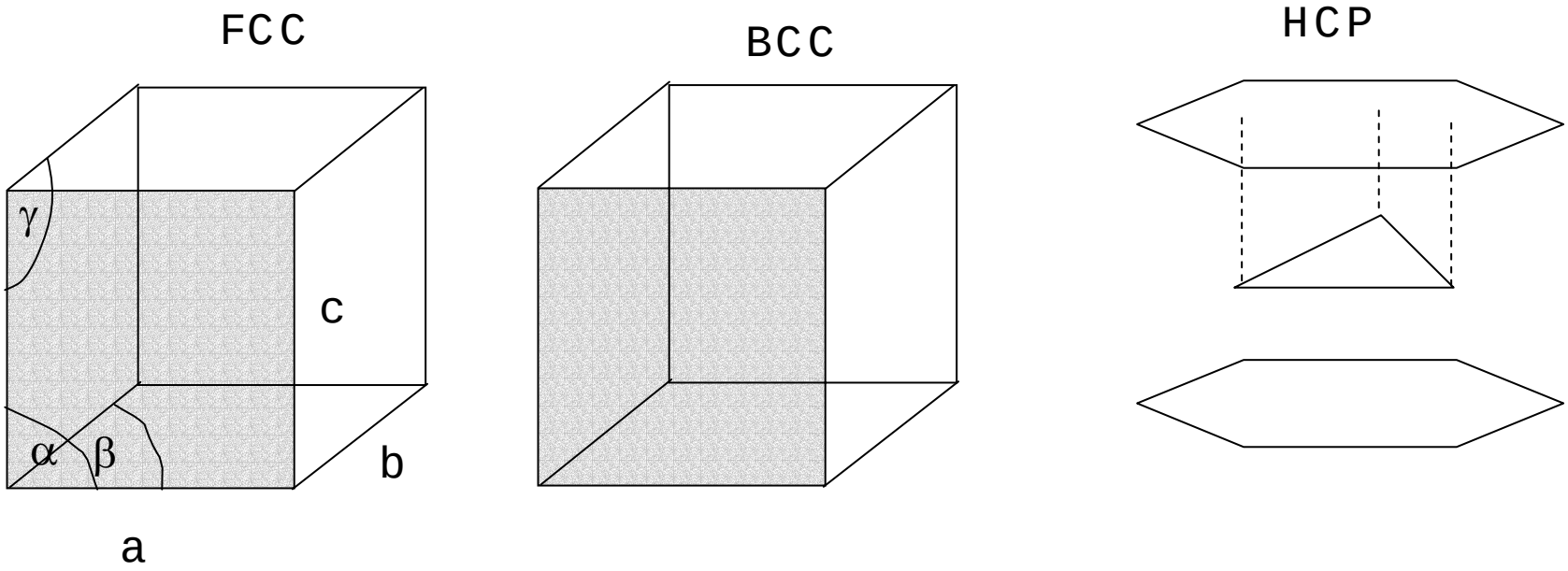


Crystal systems and unit cells: Arrangement of points in 3D space, defining translational and rotational symmetry

Examples: FCC, BCC, HCP

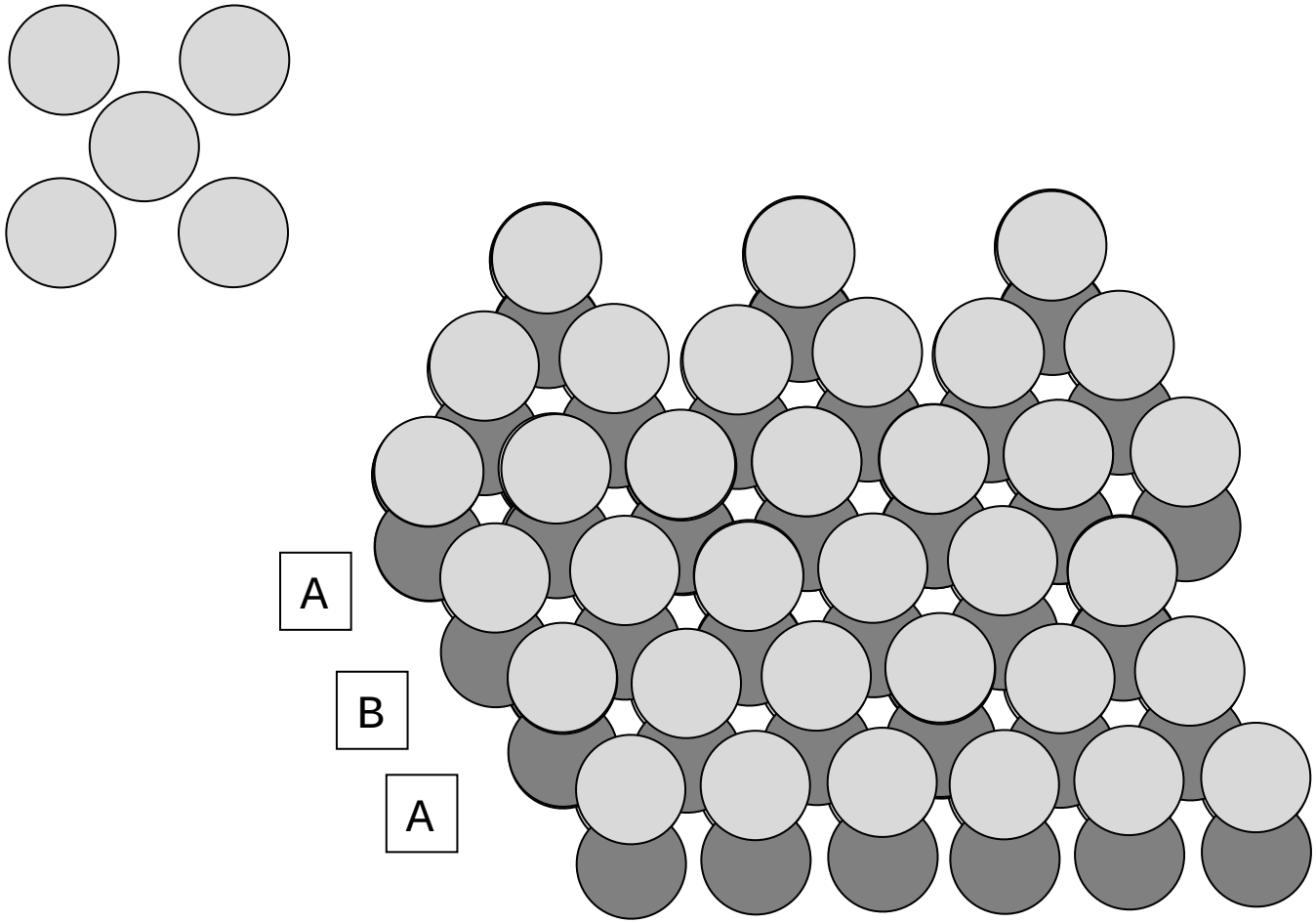


Crystal structure defined by:

- Lattice parameters

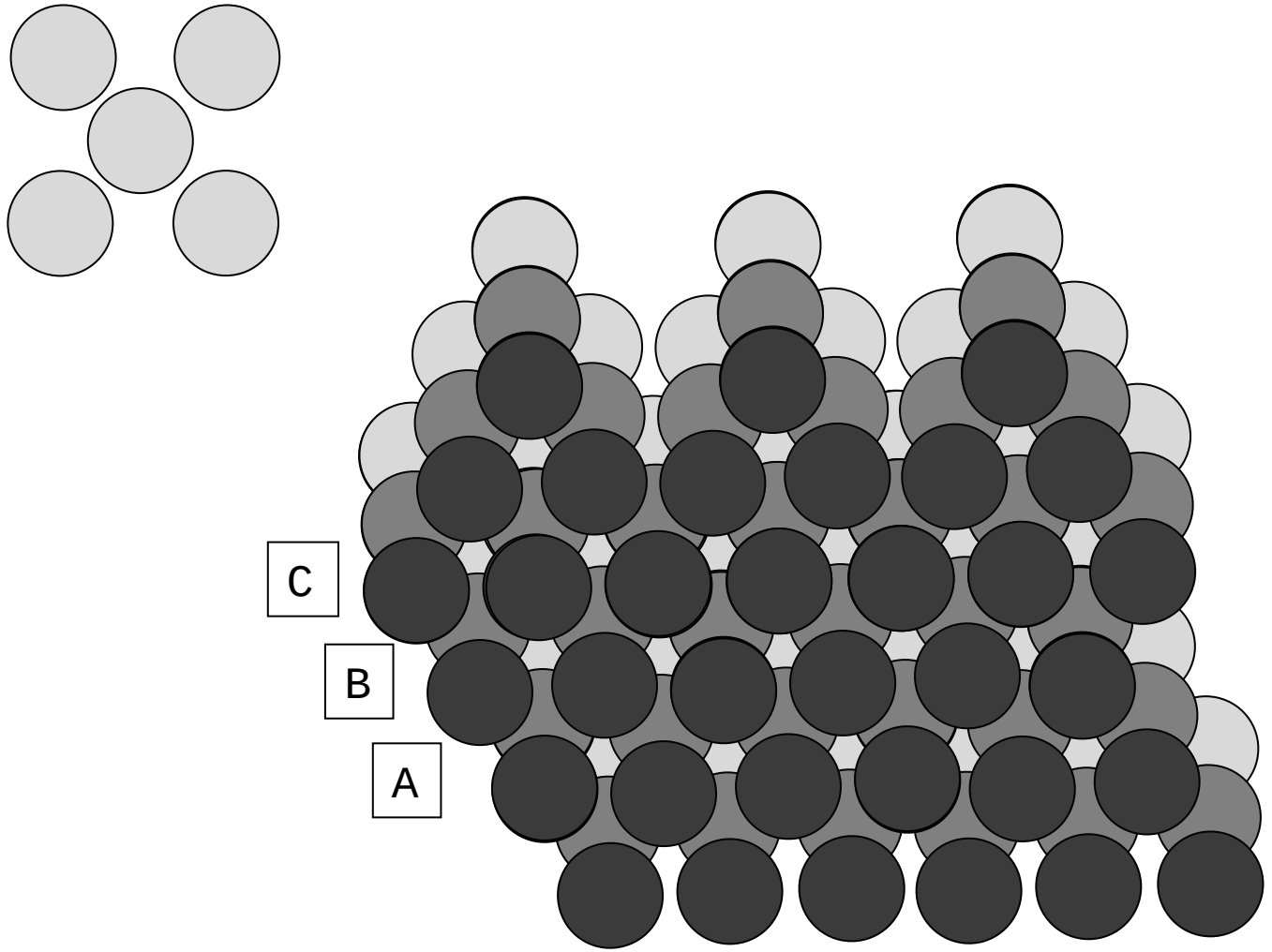
  Cubic systems: $a = b = c; \alpha = \beta = \gamma = 90^o$
- Coordination number
- Atomic packing factor

HCP vs.FCC



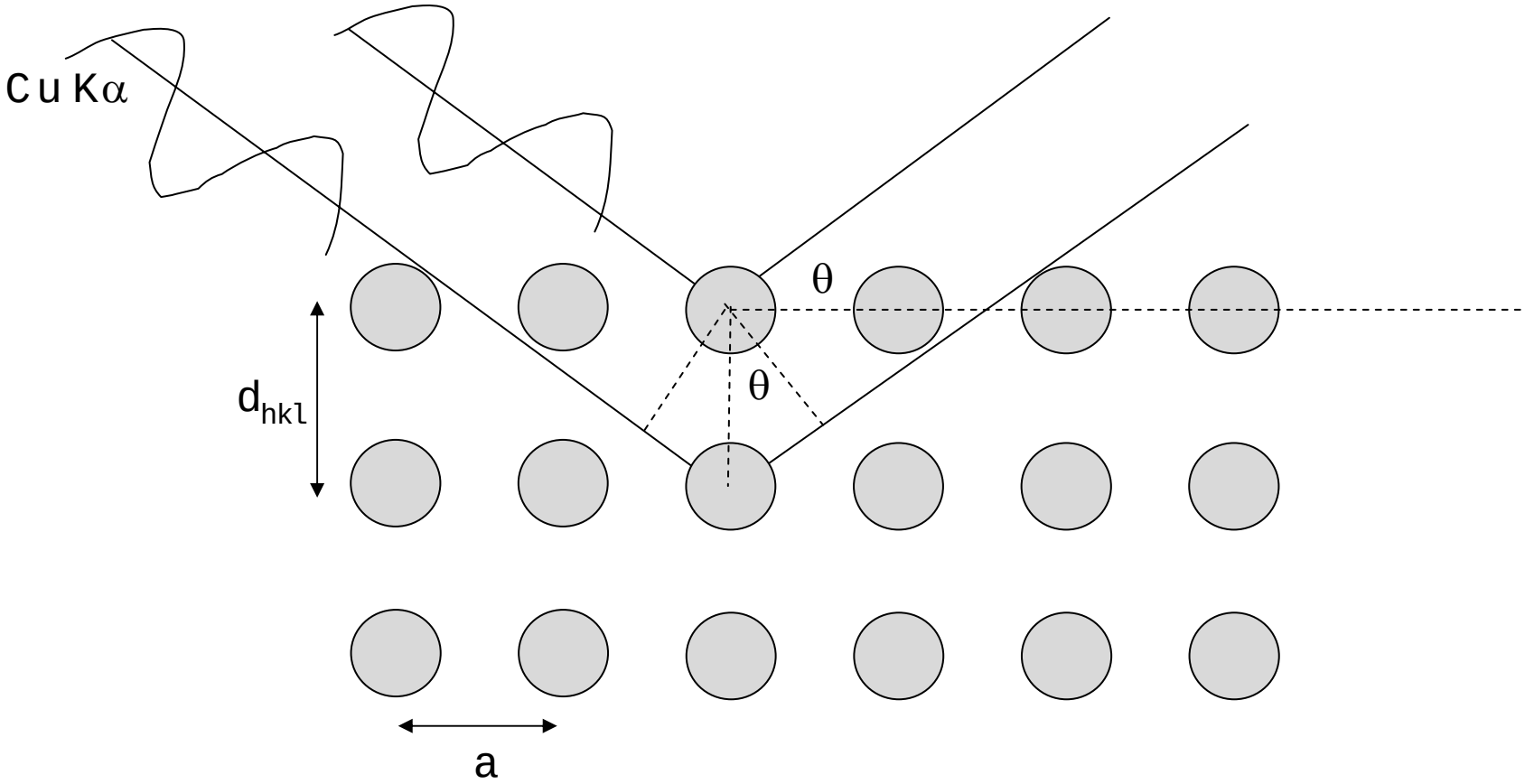
HCP

HCP vs.FCC



FCC

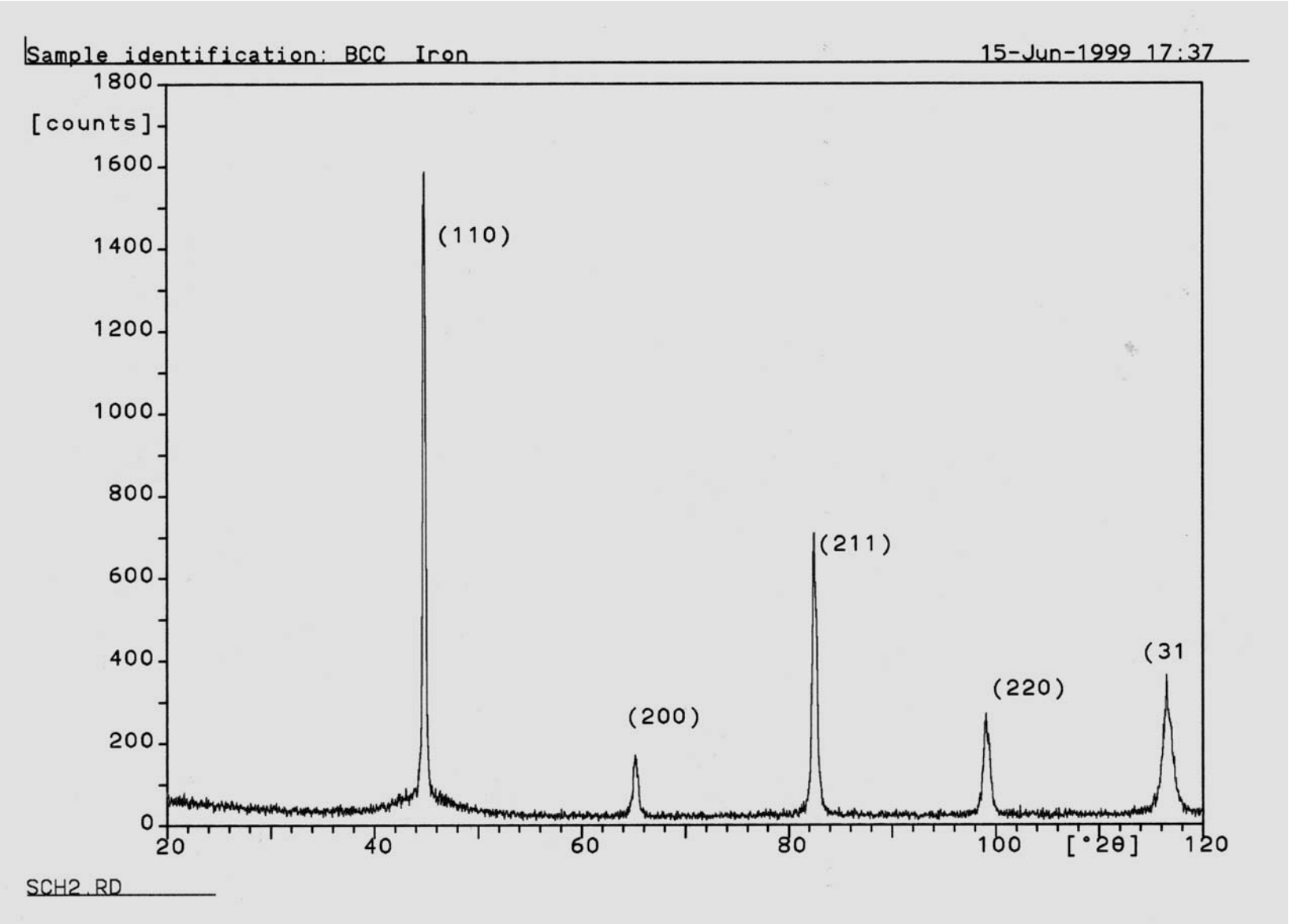
Crystal structure identification (powder or polycrystal)



Bragg Diffraction Law: $n\lambda = 2d_{hkl}\sin\theta$

Plane identification: $d_{hkl} = a/[h^2 + k^2 + l^2]^{1/2}$

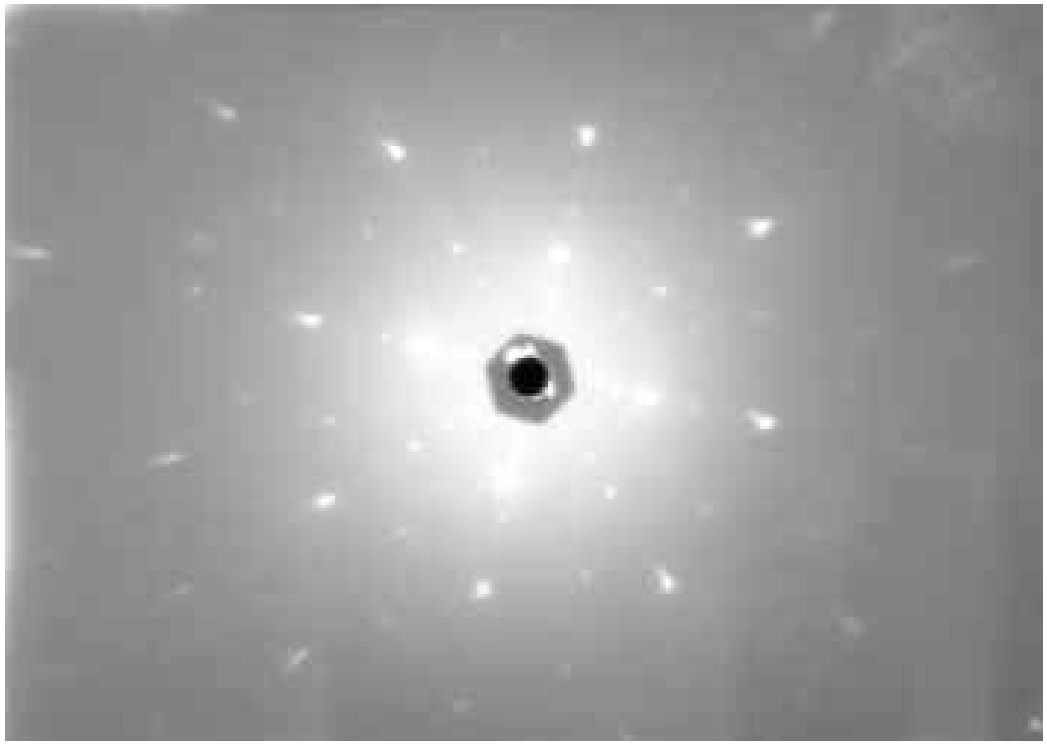
Example of Bragg diffraction spectrum



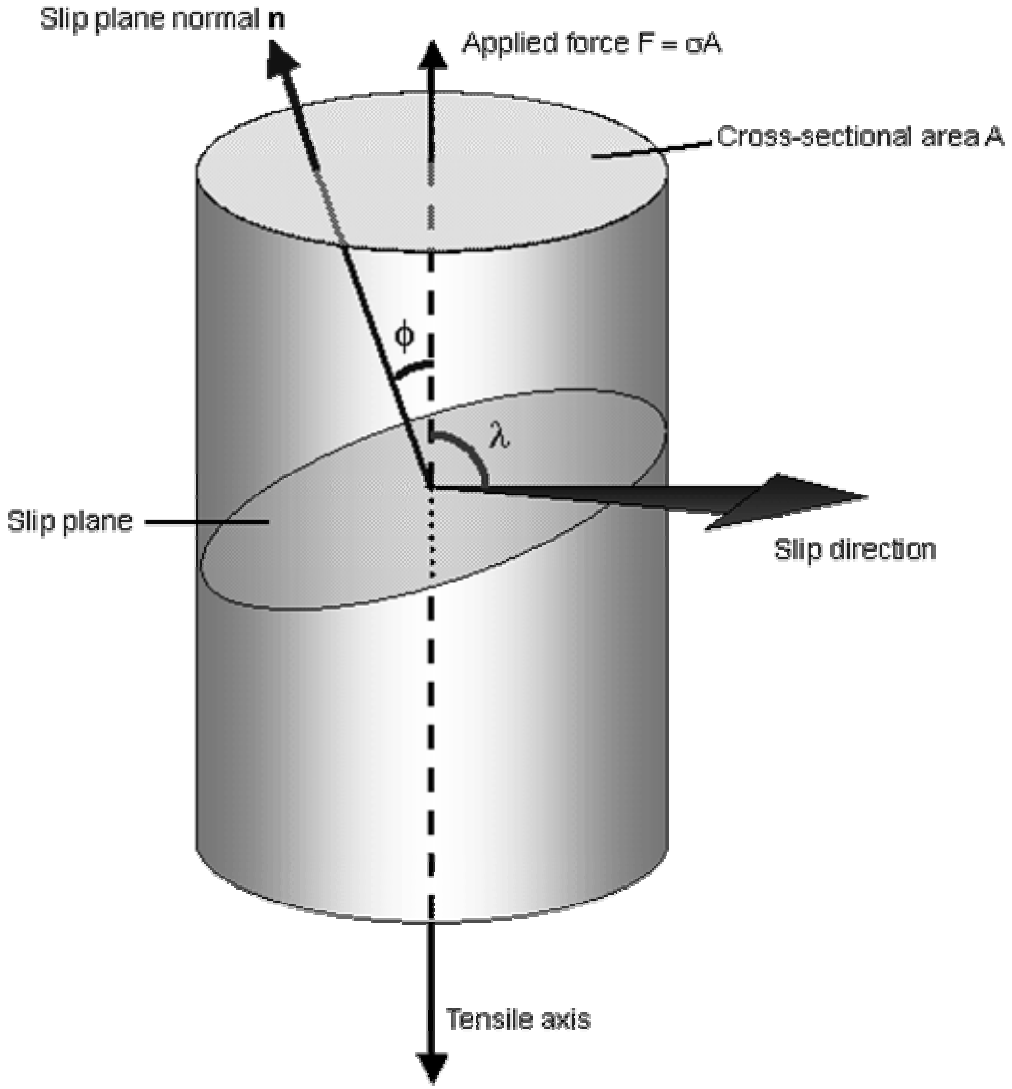
BCC Fe

Identification of single crystal orientation

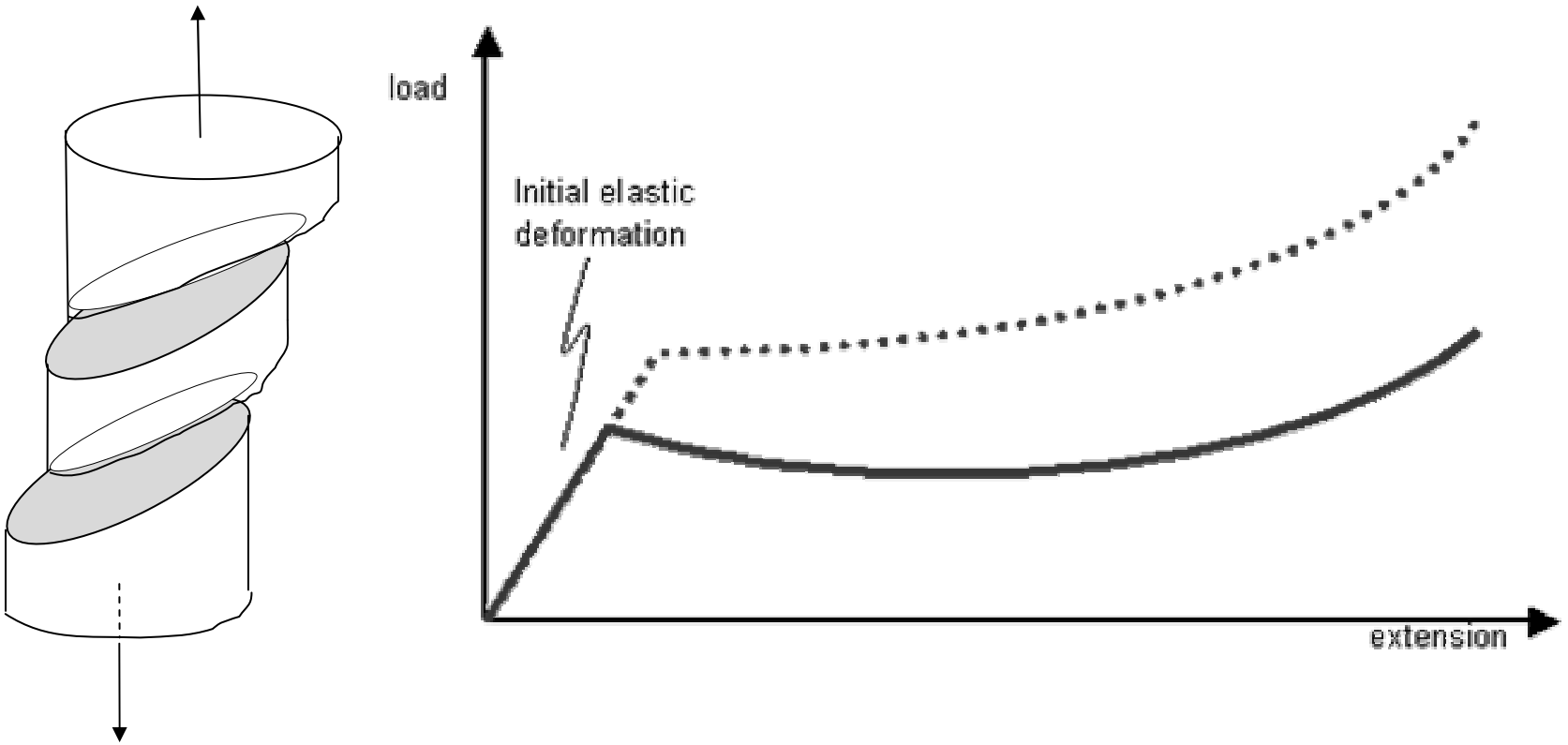
Laue (x-ray) diffraction: Points diffracted by specific planes



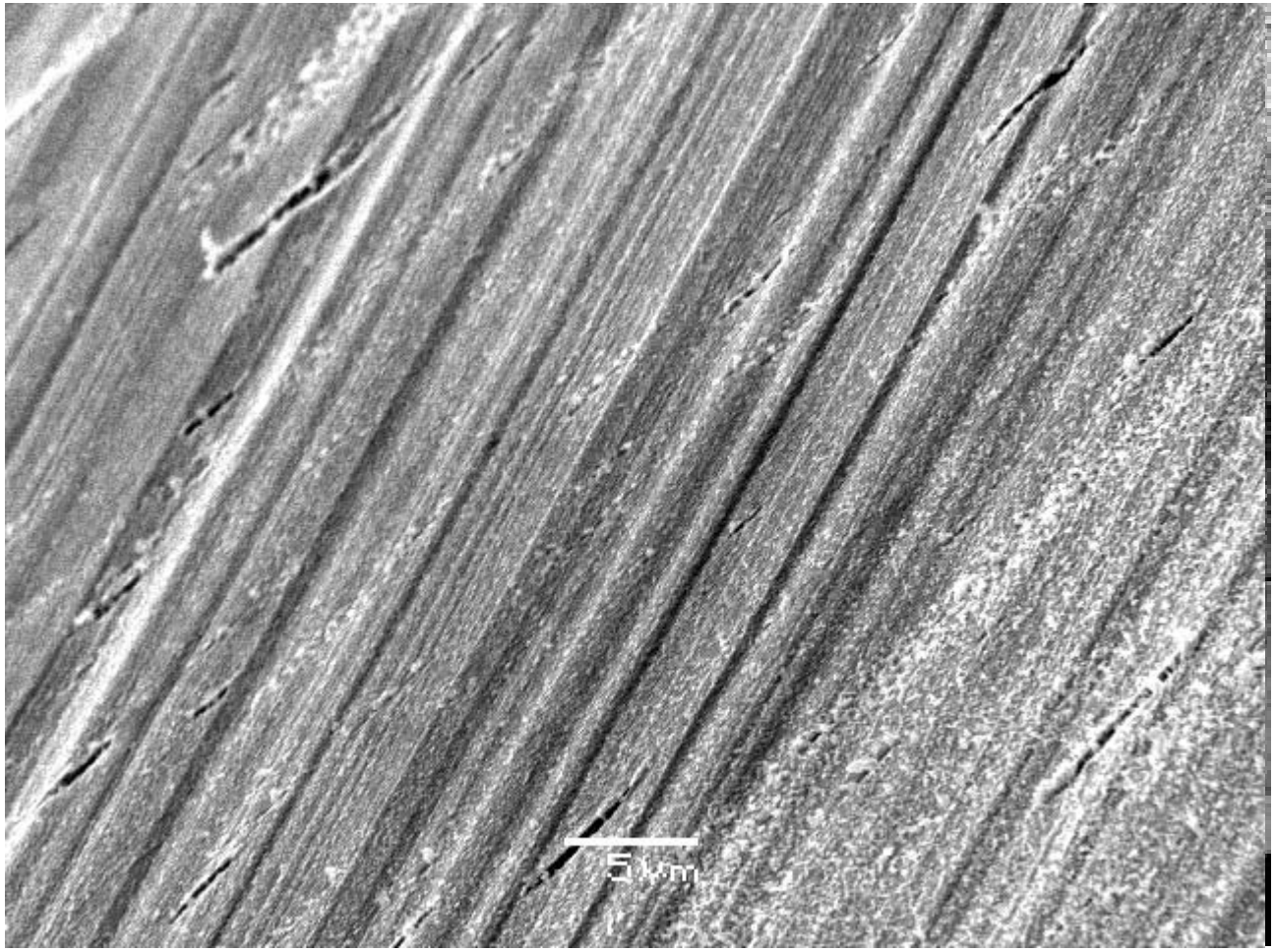
Single Crystal Deformation: Schmid Factor



Single Crystal Deformation: Critical resolved shear stress



Single Crystal Deformation: Cadmium (HCP)



$\varepsilon = 200\%$