

Advanced Condensed Matter Physics

- Materials Science from Local Structure -

Structural Dynamics

(Phase transition, Chemical reaction, Surface process)

Date : Wednesday 10:20 - 11:50

Place : 0106

Chapter 1

Introduction

- (1) Classifications of Materials
- (2) Interaction between photon and matters
- (3) What is local structure?

Chapter 2

X-ray Absorption Fine Structure

- (1) XAFS (phenomena and formulation)
- (2) XRD
- (3) Synchrotron radiation source

Chapter 3

Ferroelectrics and Structural phase transition - PbTiO_3

- (1) Comparison with BaTiO_3
- (2) XAFS and XRD
- (3) Soft mode and Debye-Waller factor

Chapter 4

Phase transition in alloys and mixtures

- (1) Structure of alloys (AuSi , PbSn , CuZn)
- (2) Structural transition in magnetic NiMn alloy
- (3) Metal-semiconductor transition in structural disordered materials
(Liquid AsTe)

Chapter 5

XAFS for Magnetic study (XMCD)

- (1) Theoretical aspects (Dirac equation)
- (2) Application to NiMn alloys (Magnetic XAFS)

Chapter 6

Debye-Waller Factor(Thermal factor) in XAFS -theory-

- (1) Cumulant expansion
- (2) Field theoretical approach
- (3) Path integral approach

Chapter 7

Determination of anharmonic potential from thermal factor

- (1) Br⁻ solutions
- (2) Water exchange reaction
- (3) Quantum effect in chemical reaction from path integral

Chapter 8

Mesoscopic systems

- (1) Thin layer (Blue LED, InGaN) fluorescence XAFS
- (2) Micro cluster (Ag/Si) TCEY
- (3) Multilayer magnetic systems

Chapter 9

Introduction to phase transition

- (1) Landau theory
- (2) Renormalization approach
- (3) Lee & Yang theory