

## Materials Science and Technology

Prof. Maurizio De Crescenzi  
Dipartimento di Fisica  
Università degli Studi di Roma "Tor Vergata"  
e-mail: [decrescenzi@roma2.infn.it](mailto:decrescenzi@roma2.infn.it)  
tel: 06 72549 4547 ( desk) 4532 ( laboratory)

The most important class of materials

The cycle of materials

Cohesion forces, matter condensation

The crystalline state, glasses and other aggregation states.

X-ray diffraction, Bragg law and Miller indices

Scanning Electron Microscopy, Transmission Electron Microscopy,

EXAFS analysis, radial distribution function.

Defects, dislocations and grain boundary.

The molecular structure of organic polymers and their spatial configuration.

Silicate glasses, mineral glasses and cement. Relation between thermo-dynamical variation and atomic variation of the atomic structure: deformation of a perfect crystal, elastic deformation of materials and rubber. Visco-elastic diagram. Solid solution. Phase diagram of mixed compounds.

Metallic alloys, ceramic alloys, copolymers.

Mechanical properties, materials resistance, stress and strain deformation energy and inelastic effects. Plastic deformation of materials at low temperatures: stress and slip plane.

Deformation at high temperature, visco-elasticity at high temperature: polymers.

Thermal conductivity, electrical conductivity.

Semiconductors, junctions, diodes, transistors, solar cells, laser.

Metals: magnetic properties. Superconductors.

Laboratory experiences: Scanning Tunneling Microscopy, Synthesis and growth of a nano material: carbon nanotubes, Auger and XPS spectroscopy of a stainless steel. Transmission and optical properties of materials. Nano-indentation. Characterization of Silicon and Carbon nanotubes thin film/Silicon solar cells

Books:

W.E.Callister Jr.

"Materials Science and Engineering: An Introduction",  
John Wiley and Sons, New York ISBN 0471- 58128 -3

L.H.Van Vlack

"Elements of Materials Science and Engineering"