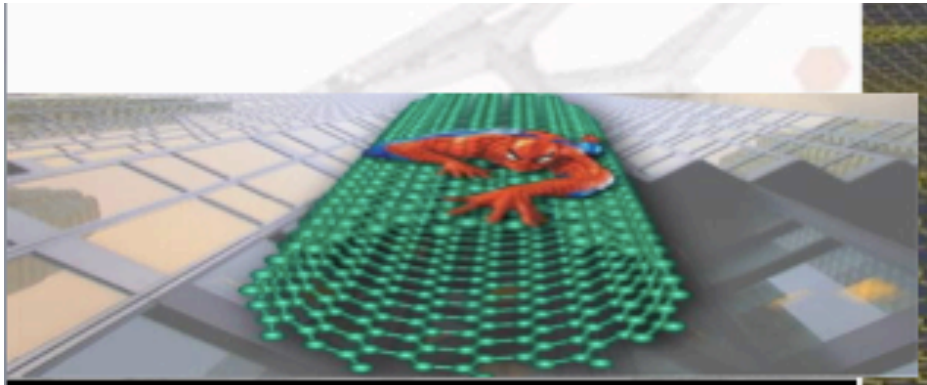
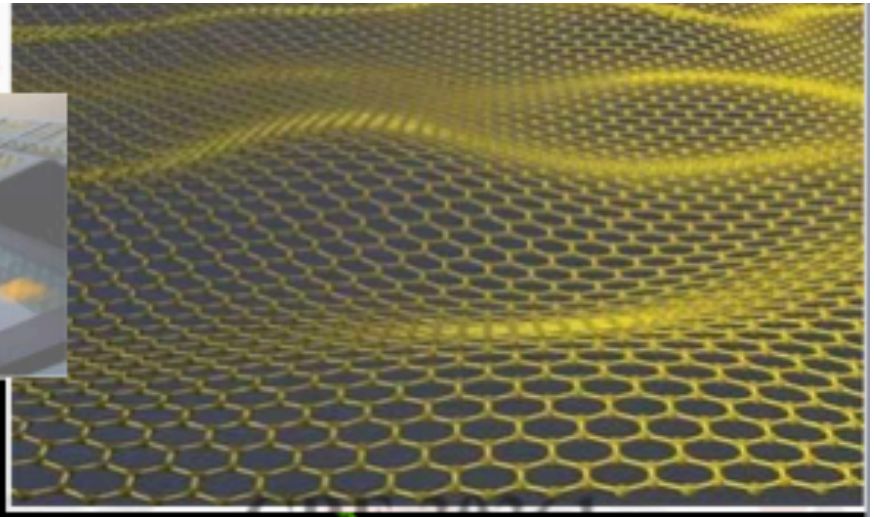
Fundusze Europejskie
Wiedza Edukacja Rozwój

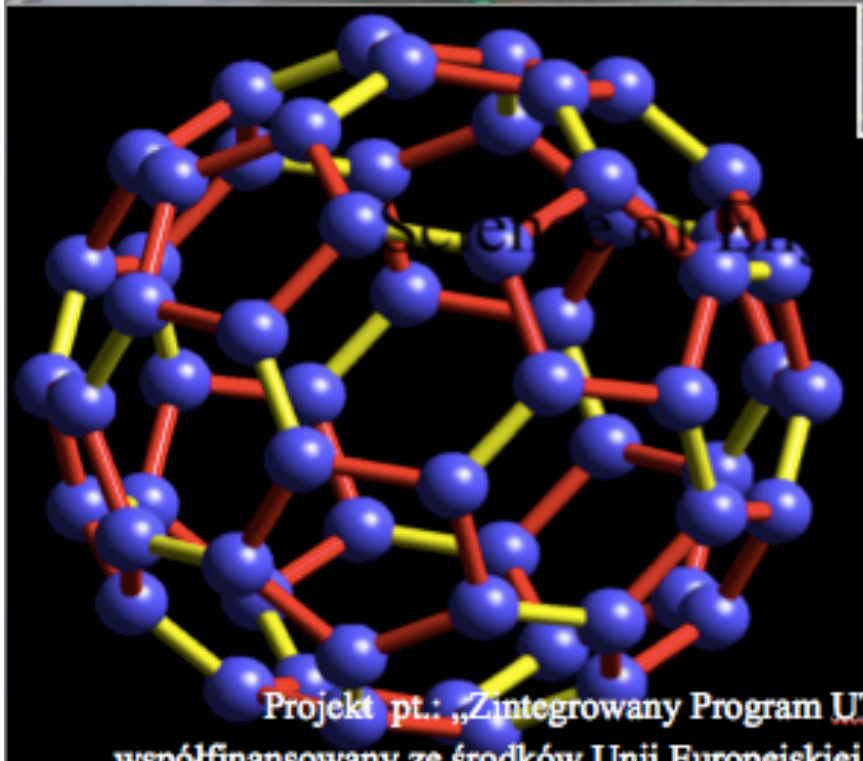
Rzeczpospolita Polska

UNIWERSYTET TECHNOLOGICZNO-HUMANISTYCZNY
im. Kazimierza Pułaskiego w Radomiu

Unia Europejska
Europejski Fundusz Społeczny







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Course Number:1

Course Title: Science of Engineering Materials

Lecture №07

Nanomaterials and nanocomposites

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Nanocomposites can be defined as multiphase solid materials, where at least one of the phases has an average crystallite size (grain) in the nano range (up to 100 nm), or structures that have repeating nano-sized gaps between different phases. n a mechanical sense, nanocomposites differ from conventional composite materials because of the exceptionally high ratio of surface area to volume of the amplifying phase and / or the exceptionally high ratio of characteristic sizes. The reinforcement material may consist of particles (for example, minerals), sheets or fibers (for example, nanotubes). The region of interaction between the matrix and the amplifying phase is usually an order of magnitude larger than

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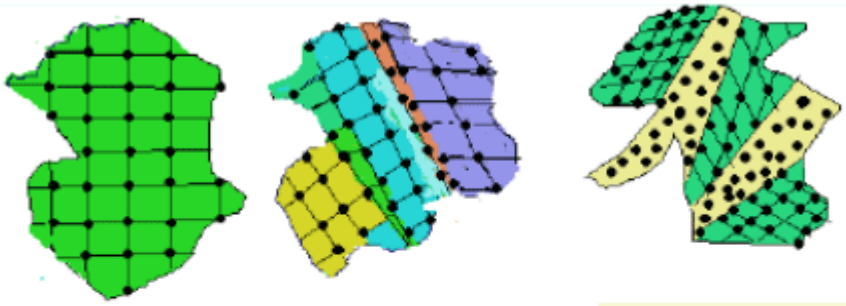
PARTICLE CAN BE SINGLE CRYSTAL, NANO CRYSTAL, POLY CRYSTALLINE, NANO CRYSTALLINE OR AMORPHUS

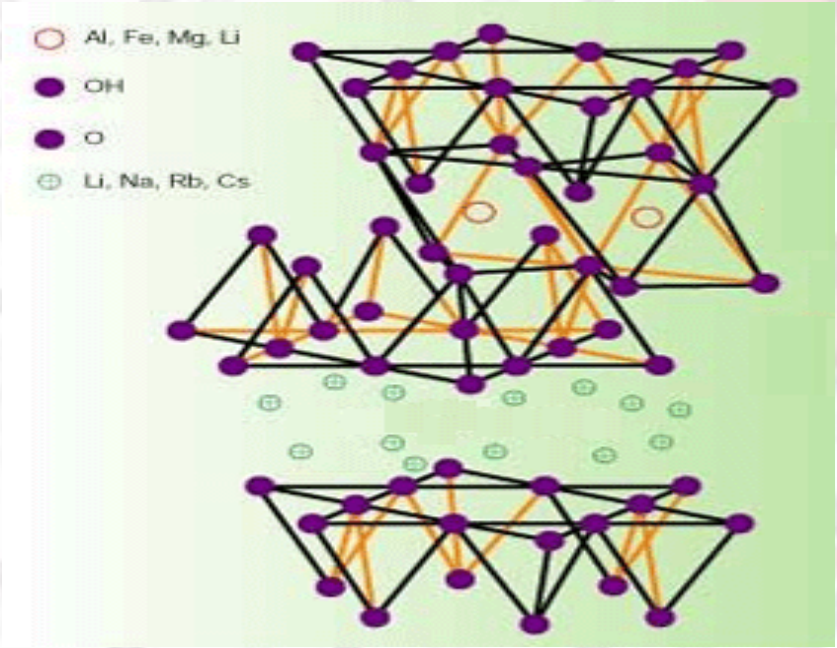


SINGLE CRYSTAL PARTICLE
USUALLY BELOW 10 µm IN SIZE
NANO CRYSTAL
0.01- 0.1 µm

POLY CRYSTALLINE PARTICLE
USEFUL RANGE
20-200 µm
GRAIN BOUNDARY THICKNESS 1- 2 Å

NANO CRYSTALLINE PARTICLE
10- 100 nm
0.01- 0.1 µm
GRRAIN BOUNDARY THICKNESS IS COMPARABLE TO GRAIN SIZE

Structure of silicates



The nanocomposites demonstrate significant improvements compared to unfilled polymers with a content of modified layered silicates in the range of 2 ÷ 10 weight. % Improvements are observed: - in mechanical properties such as tensile strength, compression, bending and kink; - barrier properties such as permeability and resistance to solvents; - optical properties; - ionic conductivity.

ZnO powder obtained by hydrothermal synthesis