Course Unit Descriptor

Study Programme: Physics

Course Unit Title: Synthesis and structure of nanomaterials

Course Unit Code: M18DSN

Name of Lecturer(s): Full Professor Željka Cvejić

Type and Level of Studies: Master Academic Studies in Physics

Course Status (compulsory/elective): Compulsory

Semester (winter/summer): Summer

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 8

Prerequisites: None

Course Aims:

The aim of this course is to introduce the various techniques of obtaing nanomaterials and structure characterization at the nanoscele from the theoretical and practical point od view: ranging from isolated nanostructures, through to nanostructures integrated in bulk materials.

Learning Outcomes:

After the following course the student should be able to:

- General abilities:

Reading professional literature; Search and Internet use; Writing term papers and presentations; The ability to research

- Course specific abilities:

After completing the course the student should be able to independently carry out some of the techniques of obtaining and sintering of nanoparticles and nanomaterials. Also, it is expected that students will be able to prepare samples and perform some of the following techniques and interpret the results.

Syllabus:

Theory

The synthesis methods for fabrication of inorganic nanoparticles from the liquid and gas phase (co-precipitation, sol-gel mechanochemistry, plasma based synthesis, vapour condensation, the condensation in inert gas, pyrolysis, electrodeposition). Sintering and unconventional processing (microwave sintering, Shock-wave processing). Fundamentals of conventional experimental techniques of structural characterization.

Practice

Experimental techniques based on diffraction: X-ray diffraction, neutron diffraction and electron diffraction. Spectroscopic methods: photon-photon spectroscopy (FTIR-spectroscopy, IR Raman scaattering), electron microscopy (SEM, TEM).

Required Reading:

1. *Nanomaterials: An Introduction to Synthesis, Properties and Applications*, 2nd Edition, ISBN: 978-3-527-33379-0, Dieter Vollath, Wiley, 2013
2. *Handbook of Raman Spectroscopy*, edited by Ian R Lewis, Howell G.M. Edvards, CRC Press (2001)

Weekly Contact Hours:	**Lectures:** 3	**Practical work:** 4

Teaching Methods:

Lectures, computational lab, laboratory exercises.

Knowledge Assessment (maximum of 100 points): 100			
Pre-exam obligations	points	**Final exam**	points
Active class participation	10	written exam	-
Practical work	-	oral exam	50
Preliminary exam(s)	-	Homework	20
Seminar(s)	20		