



1. **Title:** Applied hybrid materials

2. **Lecturer:** Mikhail V. Zyuzin

Assistants: Irina G. Koryakina, Pavel M. Talianov

3. **Short annotation:**

This course is devoted to the current state of rapidly developing areas of nanotechnology, material science, biophysics and others. It discusses the modern techniques of nano- and microparticle synthesis and their stabilization via polymer coating. Moreover, the methods of nano- and microparticles characterization such as electron and optical microscopy, dynamic light scattering, laser Doppler anemometry and others will be presented. As a major part of this course, application of different discussed materials in biology, medicine, optics etc. will be reviewed. Additionally, the general introduction in a “Lab-on-a-chip” concept will be explained.

4. **Study program and semester:** Quantum and hybrid materials, third semester

5. **Detailed content of the course** (8 lectures, 12 seminars):

- Introduction in Applied hybrid materials
- Synthesis of organic/inorganic nanoparticles
- Polymer coating of nanoparticles with smart materials, application in optics and medicine
- Methods of nanoparticles characterization
- Interaction of nanoparticles with cells
- Interaction of nanoparticles with animals
- Microfluidics I: introduction, methods of microfluidics, general definitions
- Microfluidics II: chip fabrication, application in biology, chemistry, catalysis and others

6. **References:**

- DOI: [10.1021/acs.chemmater.6b04738]
- DOI: [10.3762/bjnano.5.161]
- DOI: [10.1038/nmat2442]
- DOI: [10.1002/adma.201807061]
- ISBN 978-0-19-923508-7 (Hbk)
- ISBN 978-0-19-923509-4 (Pbk)

7. **Courses needed:**

Organic and inorganic chemistry, optics, introduction in biology

8. Evaluation of course progress (grading policy) and examples of assignments:

Each student will need to present a scientific paper two times pro semester. Based on these presentations, each student will receive a note.