

IPPT PAN DOCTORAL SCHOOL
TEACHING PROGRAMME
WARSAW

*Investigation of multifunctional materials: Shape Memory Alloys,
Polymers, Composites and innovative Ti alloy named
Gum Metal by various techniques*

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Development of technology, a need for materials meeting the requirements in certain conditions, and environment protection make that recently a great interest is observed in smart and multifunctional materials. Such materials are able to adapt their properties to a change of a certain factor of environment, while the adaptation may be used as a driver for another physical factor. This means that the materials can combine the property of sensor and actuator, assuring miniaturization of mass and dimensions, important for applications, in particular medical applications. This group of materials comprises shape memory alloys (SMA), shape memory polymers (SMP) and shape memory composites (SMC), based on SMA and SMP.

The proposed course contains the properties of SMA, SMP, SMC and Gum Metal, demonstrated in various conditions, related to the structure. In addition, fundamentals of the experimental mechanics, thermomechanical couplings and thermomechanics.

Main topics:

1. Introduction to experimental mechanics
2. What do we mean by thermomechanical couplings?
3. Why is infrared camera so useful in new materials study?
4. Introduction to shape memory materials: SMA, SMP and SMC
5. Application of SMA, SMP and SMC in engineering, textile and medical industry
6. Experimental studies on SMA, SMP and SMC
7. Thermo-mechanical properties of TiNi SMA, subjected to various kinds of loadings
8. Introduction to thermodynamics of martensitic forward/ reverse transition in SMA
9. Introduction to unique mechanical and structure properties of Ti β alloy Gum Metal
10. Gum Metal unique properties investigated by IR and digital image correlation DIC

The total number of lecture hours: 20, laboratory exercises: 5 hours, self-teaching: 40, direct tutoring and consultations: 10 hours.

ECTS Points: 3