



Functional materials

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Course description:

During the course students will learn about different classes of intelligent materials and a strong emphasis will be placed on their practical use in modern technologies. The course is planned to embrace both scientific and technical knowledge about functional materials that will allow students to understand their behaviour leading to present and possible future applications.

The course is divided into 2 consistent modules (7.5 hours each), covering 15 hours of lectures in total, and also includes a general introduction lecture to the subject of functional materials.

The first module, authored by Professor Krawczuk, embraces information and lectures on:

1. electrostrictive materials,
2. magnetostrictive materials,
3. piezoelectric materials,
4. shape memory materials.

The second module, authored by Professor Żak, embraces information and lectures on:

5. electrorheological fluids,
6. magnetorheological fluids,
7. nanotechnology and nanomaterials,
8. novel smart composites.

Within the course all lectures will be given by Professor Żak.

Abstract.

In 1980's a new class of materials drew attention of international scientific community that now is known as intelligent materials. It should be noticed that some of these materials, nowadays belonging to a big group of intelligent materials, have been known much earlier and have found many interesting applications such as, for example, shape memory alloys or piezoelectric ceramics. On the other hand a continuous growing interest in modern high-tech designs and applications has resulted in the search for newer and better intelligent materials that could potentially allow designers realization of their futuristic concepts.



In the context of intelligent materials it is extremely difficult to define the maturity point of the intelligent material technology for practical applications. However, it is believed that the concept of intelligent materials became legible as the result of a pioneering national research program in late 1980's in Japan. As a consequence of that in 1990's, the same as at the beginning of the 21st century, an extremely great interest and sudden increases in scientific research in the area of intelligent materials is observed worldwide.

This research area can be characterised by diverse terminology: intelligent materials, smart materials, adaptive materials or multifunctional materials.

It should be said that there is no acceptable definition of intelligent materials. Practically that can be used independently or as components of so-called intelligent or functional structures. As such an intelligent material should functionally join together characteristics of a sensor (1) , processor (2) and actuator (2), as well as should generate necessary feedback (4) information. But primarily these intelligent materials should be capable to react based on external stimuli by changing its properties in order to produce a desired and effective response. According to a popular definition by Takagi, those material that possess only 2 or 3 characteristics out of 4 from the above mentioned, can be only called smart. Intelligent materials can react in real time or in a similar time scales.

In general all functional materials can be divided into the following groups:

1. Colour changing materials
 - photochromic materials
 - thermochromic materials
 - electrochromic materials
2. Light emitting materials
 - electroluminescent materials
 - fluorescent materials)
 - photoluminescent (phosphorescent) materials
 - cathodoluminescent materials
 - thermoluminescent materials
 - radioluminescent materials
3. Moving materials
 - conducting polymers
 - dielectric elastomers



- electrostrictive materials
 - magnetostrictive materials
 - piezoelectric materials
 - polymer gels
 - shape memory alloys (SMA)
4. Temperature changing materials
- thermoelectric materials
 - density changing fluids
 - magnetorheological fluids MRFs
 - electrorheological fluids ERFs
5. Self-assembling materials
- self-assembling materials
 - self-repairing materials, self-healing materials
 - self-repairing materials, self-healing materials

TERMINY WYKLADÓW			
Data	Dzień tygodnia	Godzina	Sala
2014-02-26	Środa	8.15-10.00	EiA E28
2014-03-05	Środa	8.15-10.00	EiA E28
2014-03-12	Środa	8.15-10.00	EiA E28
2014-03-19	Środa	8.15-10.00	EiA E28
2014-03-26	Środa	8.15-10.00	EiA E28
2014-04-02	Środa	8.15-10.00	EiA E28
2014-04-09	Środa	8.15-10.00	EiA E28
2014-04-16	Środa	8.15-9.00	EiA E28