

# Warsaw University of Technology | Doctoral School No. 1

Course offered in the Doctoral School No. 1  
– Spring semester of the 2021/2022 academic year

TITLE
Novel ceramic matrix composites. Design, processing, properties and application.
CONDUCTING UNIT
Doctoral School No. 1
SCIENTIFIC DISCIPLINE
Materials engineering
IMPLEMENTING UNIT
109000 - Faculty of Materials Science and Engineering
FULL DESCRIPTION
<p>Ceramic matrix composites becoming more and more attractive materials for various industrial applications since their properties can be tailored through the selection of ceramics, reinforcements and microstructures. Different metals and intermetallic materials are used as reinforcing phase. Incorporation of reinforcing phase into ceramic matrix allows to improve properties, such as yielding, toughness, flexural strength, the hardness, the wear resistance and also others. Novel ceramic matrix composites linked more than one ceramics and metal, have complex structures and are called hybrid. Composites with complex structures have a spectrum of known and as yet unknown properties. Such composites are intensively investigated in last years, however the state of knowledge concerning complex structure is inconsiderable. In complex structure of composites the reaction on the crack propagation has not been thoroughly studied. However, during the last years the complex structures have attracted scientific interest because in such materials synergistic effect of different mechanisms of crack energy dissipation is predicted. In composites, proposed in the project effective influence of phases, their size and distribution on crack propagation and mechanical properties is expected.</p> <p>Proposed lecture will be concentrated on novel ceramic matrix composites with complex structure. However, the background and basic knowledge of ceramic matrix composites will be firstly discussed. The concept of a novel ceramic matrix composites, designing of their microstructure and properties will be presented. Processing, properties and potential applications of them will be analysed and presented at the examples of composites base on literature as well as on own investigated materials.</p> <p>Lecture will be divided at the following parts:</p> <ul style="list-style-type: none"><li>• Background of ceramic matrix composites</li><li>• Classification of ceramic matrix composites</li></ul>

<ul style="list-style-type: none"> <li>• Reinforcement ( metal, intermetallic material)</li> <li>• Microstructure of ceramic-metal and ceramic-intermetallic composites</li> <li>• Interfaces in ceramic matrix composites</li> <li>• Nanocomposites</li> <li>• Hybrid composites</li> <li>• Fabrication of ceramic matrix composites</li> <li>• Properties of ceramic matrix composites</li> <li>• Applications of ceramic matrix composites</li> <li>• New approach in designing of ceramic matrix composites</li> </ul>		
<b>LITERATURE</b>		
K. Konopka, A. Miazga, Kompozyty ceramika-metal, Oficyna Wydawnicza PW 2017, other books and papers in English subject ceramic matrix composites, full list of appropriate literature will be done on the lectures		
<b>LEARNING OUTCOMES</b>		
PhD students will enlarge the base knowledge about specific properties and processing of ceramics and composites with ceramic matrix. They will possess the skills of designing composites with desired microstructures and properties, especially novel composites with complex structure with contribution of metals and intermetallic materials. Moreover, they will have a skills to select the proper method of fabrication of composites.		
<b>ASSESSMENT METHODS AND CRITERIA; COURSE COMPLETION FORM</b>		
Students will prepare the individual elaboration in which the proposition of new composite with ceramic matrix will be presented. The structure, properties and possible method of fabrication as well as potential applications of composite must be described.		
<b>LANGUAGE OF THE COURSE</b>		<b>ECTS CREDITS</b>
English		2
<b>TYPE OF CLASSES</b>	<b>NUMBER OF HOURS</b>	<b>COURSE INSTRUCTOR</b>
Lecture	15	Katarzyna Konopka, prof. dr hab. inż.