

## LABORATORY WORKSHEET

<b>WIMiR – „Materials Science” laboratory</b>	<b>Date:</b> .....	<b>Mark:</b> .....	.....
<b>Student:</b> .....	<b>Group:</b> .....	<b>Exc.no</b> .....	

**1. Bending strength** test. A diameter of the selected ceramic sample must be measured, then the sample is placed onto the supports of the testing machine (see Fig.1 of the “Operating Instructions” *OI*).

**ATTENTION! The testing machine is operated by the supervisor.**

During bending test a force which causes decohesion (destruction) of the sample will be recorded. All data required to calculate bending strength of the ceramics should be noted in Table 1. The bending strength should be calculated with Equation (1) – see *OI*.

Subsequently, metallic and composite materials will undergo 3-point bending test.

Quantitative and qualitative observations related with the behaviour of the samples under variable load must also be inserted into Table 1.

*Table 1. Bending test data*

<i>Sample description</i>	<i>Supports separation L [mm]</i>	<i>Rod diameter d [mm]</i>	<i>Force causing decohesion of the ceramic sample F [N]</i>	<i>Bending strength of the ceramic sample [MPa]</i>
<i>Ceramics,.....</i>	50			

*Observations of the differences in behaviour of all samples under variable load:*

2. **Fracture toughness.**  $K_{Ic}$  measurements should be performed in a following manner:

On the basis of the data present at given photograph of Vickers indenter imprint, namely loading force, Vickers hardness (HV), Young's modulus (E) and scale bar length,  $K_{Ic}$  should be calculated using equation (2) – see *OI*. All data should be collected in Table 2.

Table 2.  
Data required for fracture toughness calculation

Material:..... Load [kg]:.....Loading force [N]:..... Hardness [GPa]:.....Young's modulus [MPa]:..... Length of the scale on a photograph [mm]:.....												
	Lengths of the imprint diagonals at the photograph; $d_1, d_2$ [mm] Lengths of cracks at the photograph; $l_1, l_2, l_3, l_4$ [mm]						Average values [mm]		Average real length of the Vickers imprint diagonal $d$ [m] Average real length of the cracks $l_{sr}$ [m]		$K_{Ic}$ [MPa m <sup>0.5</sup> ]	
	$d_1$	$d_2$	$l_1$	$l_2$	$l_3$	$l_4$	$d_{sr}$	$l_{sr}$	$d$	$l_{sr}$		
1												
2												
3												
4												
Average value												