LABORATORY WORKSHEET

WIMiR „Materials Science" - laboratory	Date:	Exercise no.:	Mark: .....
Student:	Group:		Supervisor: .....

1. First task is to determine the freely settled density and tapped density of ceramic powder. A type of ceramic powder is given by the supervisor.

Type of material. **.....** physical density of the material $\mathbf{d_{rz}}$ **= ..... g/cm^3**

Mass of empty calibrated cylinder $\mathbf{m_{pc}}$ **= ..... g**
Mass of the cylinder with powder $\mathbf{m_{cpr}}$ **= ..... g**
Freely settled density $\mathbf{d_{nas} = (m_{cpr} - m_{pc})/25}$ **..... g/cm^3**

Powder volume after mechanical tapping $\mathbf{V_u}$ **= ..... cm^3**
Tapped density $\mathbf{d_{nas\cdot us} = (m_{cpr} - m_{pc})/V_u}$ **..... g/cm^3**

2. Consequently, using the same powder, one has to form by uniaxial pressing three samples, using steel matrix. Pressing load is given by the supervisor.

Pressing load **F = ... kG** Diameter of pressing punch $\mathbf{\Phi_{st}}$ **= ..... mm**
Forming pressure **P = ... kG/mm^2 = ... MPa**; Form diameter $\mathbf{\Phi_f}$ **= ..... mm**

3. The following values must be calculated: **a)** apparent density $\boldsymbol{d_{pi}}$ of the compacts (ceramic green bodies), by their weight and volume determination (measuring the height $\boldsymbol{h_i}$ and assuming, that the diameter is $\mathbf{\Phi_f}$);
b) relative density of the samples, $\boldsymbol{d_{wi} = (d_{pi}/d_{rz})*100\%}$, and also their porosity $\boldsymbol{p_i = 100\% - d_{wi}}$. The mean values of the mentioned parameters must also be calculated.

Sample No	Green body mass, $\boldsymbol{m_i}$, g	Green body height, $\boldsymbol{h_i}$, mm	Green body volume, $\boldsymbol{V_i}$, cm^3	Apparent density, $\boldsymbol{d_{pi}}$, g/cm^3	Relative density, $\boldsymbol{d_{wi}}$, %	Porosity $\mathbf{p_i}$, %
1						
2						
3						
Mean val.	--------	--------	---------			

4. Analogically to point 3, one has to determine the apparent density $\boldsymbol{ds_{pi}}$ of sintered ceramic bodies (sinters). One has also to calculate relative density $\boldsymbol{ds_{wi}}$ and porosity $\mathbf{ps_i}$ of sinters. Subsequently, one has to determine the linear shrinkage during sintering, using following formula $\mathbf{\Delta_{Li} = (\Phi_f - \Phi s_i)/\Phi_f)*100\ \%}$ and estimate the volume shrinkage $\mathbf{\Delta_V}$ using: $\mathbf{\Delta_{Vi} = 3*\Delta_{Li}}$**.** formula. Finally, the mean values of the mentioned parameters must be calculated.

Sample No	Sinter mass, $\boldsymbol{ms_i}$, g	Sinter height, $\boldsymbol{hs_i}$, mm	Sinter diameter, $\boldsymbol{\Phi s_i}$, mm	Sinter volume, $\boldsymbol{Vs_i}$, cm^3	Sinter apparent density, $\boldsymbol{ds_{pi}}$, g/cm^3	Relative density, $\boldsymbol{ds_{wi}}$, %	Porosity, $\mathbf{ps_i}$, %	Linear shrinkage during sintering, $\mathbf{\Delta_{Li}}$, %	Volume shrinkage related to sintering, $\mathbf{\Delta_{Vi}}$, %
1									
2									
3									
Mean val.	-------	------	------	-------					