

Secretariat - C/O BCerS  
Avenue Gouverneur Cornez, 4  
B-7000 MONS (Belgium)

## Contract 201598

This contract is established following the decision of the JECS Trust Board of 7 January 2016. It is entered into by and between:

**JECS Trust**, a trust incorporated under the laws of Belgium, and having its registered office at avenue Gouverneur Cornez 4, 7000 Mons, Belgium.

and

The **Alexander Dubček University of Trenčín/ Vitrum Laugaricio - Joint Glass Centre** incorporated under the laws of **Slovak Republic**, and having its registered office at **Študentská 2, 911 50, Trenčín, Slovak Republic**.

Purpose of the Contract

The JECS Trust will provide funds in connection with a project "**Stay of Alexandra Ewa Nowicka in Lyon - Chemical durability, ageing and mechanical properties of zirconia-based dental ceramics**", defined in Annex 1 hereto (the "Project").

The JECS Trust and the **Alexander Dubček University of Trenčín/ Vitrum Laugaricio - Joint Glass Centre** are hereinafter referred to as the "Trust" and the "Receiving Party", as the case may be. JECS Trust and the **Alexander Dubček University of Trenčín/ Vitrum Laugaricio - Joint Glass Centre** are hereinafter collectively referred to as the "Parties".

Now, therefore, the Parties agree as follows:

### **1. Focus**

The main objective in the expenditure of Trust money is the promotion of student/young researcher activities, but not exclusively so. For all such activities, the Journal of the European Ceramic Society (the Journal) is to be consulted in respect to any plans for publication.

### **2. Responsibility**

The responsibility for the organisation of the project lies with the Receiving Party. Any financial or other claim arising from the project is the concern of the Receiving Party.

### **3. Advertising**

Any paper/advertising/etc. in relation with the project must acknowledge the contribution of the Trust. The logo of the Trust must be displayed or, if no such illustration is possible, a written reference must be made to the Trust contribution.

### **4. Budget**

In the present contract, the maximum amount allowed for the project will be of **7.750,00 €**. This sum is based on the budget defined in Annex 2 as prepared by the Receiving Party and agreed by the Trust.

50 % of that sum can be given in advanced, 4 months before the beginning of the project.

No supplement will be given if the project costs exceed the agreed sum.

### **5. Expense Statement**

At the end of the project, the Receiving Party must complete an Expense Statement. A single table is to be filled out for the entire project and completed with proofs of the actual expenses incurred, which must be within the sums indicated in Annex 2.

An Expense Statement that is not signed or that is not accompanied by original documents or, if not, by certified photocopies cannot be accepted.

Funds will be available for only 60 days after the end of the project. It is therefore essential to turn in the Expense Statement in a timely manner. Late submission will result in no reimbursement.

If, for any reason, the project for which the fund is provided can not take place, the sums allowed in advance must be reimbursed as soon as the cancellation is confirmed. Any sum already engaged and not reimbursable by the Receiving Party must be explained in an Expense Statement and agreed by the Trust.

#### **6. Report**

In addition to the Expense Statement, the Receiving Party must write a full report presenting the achievements made for the projects. This report must **be** signed and send with the expense statement, at the end of the project.

A short summary is also required on maximum one A4 page.

#### **7. Publication:**

If the Receiving Party intends to publish certain papers in a scientific Journal compatible with the content of the Journal of European Ceramic Society, it is agreed that those papers have to be submitted to JECS, which reserves the right to determine the final approval of those papers.

#### **8. Decision:**

In all cases, the decisions of the Trust shall be final.

#### **9. Disputes**

This Contract shall be governed by Belgian law. All disputes arising in connection with this Contract shall be finally settled under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by 1 (one) arbitrator appointed in accordance with such Rules. The arbitration shall be held in Mons, Belgium, and shall be conducted in English. Judgment upon the award rendered by the arbitrator may be entered in any court having jurisdiction.

In witness whereof, the Parties have executed 2 (two) original copies of this Contract on \_\_\_\_\_, each Party acknowledging receipt of one original copy'

JECS Trust **It**

By \_\_\_\_\_  
Name: Prot. A./Ceriche  
Title: President

JECS Trust

Name: Df. FrajTC+s^Cambier  
Title: Secreiafy

**Alexander Dubček**  
Laugancio - ,

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Name: **Jozef Habánik**  
Title: **rector**

**Alexander Dubcek University of Trencin/ Vitrum**  
Laugaricio - Joint Glass Cervtre

Name: **Dusan Galusek** /  
Title: **head of the laboratory**

**Alexander Dubcek University/of Trencin/ Vitrum**  
Laugaricio - Joint Glass Centr

By \*  
Name: **Alexandra Ewa Nowicka**  
Title: **PhD Student**

# **Annex 1 - The project**

## **Stay of Alexandra Ewa Nowicka in Lyon Chemical durability, ageing and mechanical properties of zirconia-based dental ceramics 01/2016 - 12/2016**

The proposed research/collaboration activity is closely related to the topic of PhD thesis of a PhD student of the applicant, prof. Galusek, which is dedicated to study and evaluation of corrosion resistance and its influence on mechanical durability and wear resistance of commercial dental materials. The scientific background of the planned exchange programme can be outlined as follows.

Ceramic materials have been widely studied in recent years as part of a strategy aimed at avoiding intraoral metals in dental implants, and also due to their excellent osseointegration and favorable mechanical properties. Due to its superior flexural strength and fracture toughness, combined with the possibilities to be accurately processed to complex geometries using CAD-CAM technologies or low-pressure injection molding a ceramic made of zirconium oxide polycrystals stabilized in their tetragonal form by the addition of 3 mol% of yttrium oxide (denoted as 3Y-TZP) is a material of choice in advanced dental applications and dental implantology.

However, as shown in hip implants made of 3Y-TZP, the ceramics are vulnerable to low temperature hydrothermal degradation (LTD), a phenomenon in which, due to the presence of water, the t-m phase transformation is triggered at the ceramic surface. It results in a volume expansion of the grains, inducing surface roughening, micro-cracking and possibly loss of strength. Hydrothermal degradation is time- and temperature dependent and occurs at temperatures as low as 37 °C. It is well established that surface treatments such as polishing, grinding or sandblasting routinely applied in shaping of dental implants may trigger the t-m transformation, build-up residual stresses and/or create critical-size defects and also affect the susceptibility of 3Y-TZP ceramics toward hydrothermal degradation.

Another factor influencing the properties of dental implants is corrosion caused by excessive consumption of acidic food and beverages combined with poor mouth hygiene, or some health issues associated with excessive production of gastric acid, which may be present intra-orally following vomiting and gastroesophageal reflux. Unlike natural teeth, where self-healing of corrosion defects is in operation, the corrosive damage of artificial dental materials is always cumulative. Our last un-published results indicate that acidic corrosion of 3Y-TZP dental ceramics is associated with leaching of yttrium from zirconia ceramics, resulting in partial destabilization of tetragonal zirconia and measurable increase of the content of monoclinic phase at the surface. This, in turn, might result in increased susceptibility of the ceramics to:

1. low temperature degradation,
2. stressed applied during chewing,
3. decreased tolerance to surface damage and microcracking, resulting in overall decrease of mechanical strength and wear resistance and hence, decreased life expectations for dental implants.

The project activities will be therefore aimed at:

1. Study of corrosion in acidic media and its influence on ion leaching, phase composition, micromechanical and tribological properties of a commercial 3Y ITZP dental ceramic, and a Ce<sub>1</sub> TZP based nano composite developed in the framework of the European project LONGLIFE in the host institute.
2. Study of the influence of corrosion on low temperature degradation of a commercial 3Y TZP dental ceramic, and a Ce TZP based nano composite with the use of an accelerated ageing test (AAT), and its influence on micromechanical and tribological properties of the ceramics.
3. Study of the influence of the stress induced phase transformation in both corroded and un-corroded ceramics on low temperature degradation studied with the use of the AAT.

The research activities will be carried out at partner institutions as follows:

1. Alexander Dubček University of Trenčín, Slovakia: corrosion tests in acidic media, microstructural and phase characterization of corroded surfaces, micromechanical and tribological testing.
2. Institut National des Sciences Appliquées de Lyon, Lyon, France: accelerated ageing tests of both corroded and uncorroded materials.

In the frame of the project the following two mobilities are planned:

1. 1 short (5 days) visit of prof. Galusek at the host institution: data evaluation, preparation of joint research paper, preparation of final report.
2. 1 long term stay (3 months) of a PhD student from Slovakia in Lyon: accelerated ageing tests of both corroded and uncorroded materials, evaluation of the tests, phase and microstructure analysis of dental ceramics after AAT. The microstructure of aged dental ceramics will be assessed through quite conventional techniques such as X-Ray Diffraction, Scanning Electron Microscopy, mechanical resistance (4 point bending and micro-indentation), but also by Dual beam FIB-SEM to investigate the transformation and degradation in depth below the surface. In recent works, the host institution has shown that 3D analysis of the material below the surface was possible by FIB-SEM and could give insights into the microcrack network. Such experiments are done in the framework of the CLYM, which is a consortium of microscopy in Lyon, for which specific sessions will be paid.

## Annex 2 - Budget in €

(a) Costs associated with the research. Please consult the guidelines before completion.		<b>1.500 €</b>
Use of facilities and consumables at host institution: Maximum 500€/month. .	- a 1. 3 months x 500 €	1.500 €
(b) Travel/ subsistence costs:		<b>6.250 €</b>
Travel	- b1. 1, travel + accommodation, prof. Galusek (5 days), 2. travel + accommodation, 1 PhD student of prof. Galusek, 3 months	1.500 €
Subsistence 50€/day	- b2. 1. subsistence, prof. Galusek, 5 days x 50 € = 250 € 2. subsistence, PhD student of prof. Galusek, 90 days x 50 € = 4500 €	4.750 €

Total amount requested from the JECS Trust: 10.250,00 €

**Total amount allowed by the JECS Trust: 7.750,00 €**

### **Remarks from the JECS Trust board:**

- 1.500 € to travel from Slovakia to France seems too high, the grant allowed is reduced to 1.500 € for all travels during the project instead of € 3.000.
- No exceptional costs are admitted (€ 1.000 rejected). The use of exceptional equipment in the host laboratory is included in the € 1.500 allowed to for 3 months.

### **Bank account details:**

<b>Name of the bank account holder:</b>	Trenčianska univerzita Alexandra Dubčeka v Trenčíne
<b>IBAN:</b>	SK46 8180 0000 0070 0026 2758
<b>BIC:</b>	SPSRSKBA