# POTENTIAL DEGRADATION OF BONE CEMENT USED IN MAXILLO-FACIAL SURGERY

**MARCIN WEKWEJT*, BEATA ŚWIECZKO-ŻUREK, MICHAŁ BARTMAŃSKI**

DEPARTMENT OF MATERIALS TECHNOLOGY AND WELDING,
FACULTY OF MECHANICAL ENGINEERING,
GDAŃSK UNIVERSITY OF TECHNOLOGY, POLAND
*E-MAIL: MARCIN.WEKWEJT@WP.PL

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## Introduction

Bone cement is a biomaterial, which is used as a material for filling bone defects, stabilizing complicated fractures and fixing implants. As a result of various types of bone damage or tumors, it is used in maxillo-facial surgery. In this environment, bone cement is exposed to stress, aggressive solution and corrosive agents in the case of bonding metal implants [1-5].
The purpose of this study is to examine its potential degradation in oral cavity. The aim of selected research is to observe the quality of obtained bone cement and checking the effect of the artificial saliva solution on it.

## Materials and Methods

The research was carried out on bone cement. It was prepared by manual mixing at 2 spins per seconds and formed into square-shaped samples of 20x20 mm and a thickness of approximately 1.5 mm (FIG. 1). In addition, parts of the samples were applied to 2 mm thick titanium plates.

FIG. 1. Bone cement sample.

The following research were carried out on: topography of the surface using scanning electron microscope, wetting angle of the surface using optical tensiometer, absorption of the solution for 1h and 24h, corrosion in the artificial saliva solution.

## Results and Discussion

Surface topography was observed using scanning electron microscope. The average number of pore on the surface of 700x1200 μm was 18x and their approximate size was 10-30 μm. An example of topography (magnification 100x) and pore (magnification 2000x) is shown in FIG. 2.

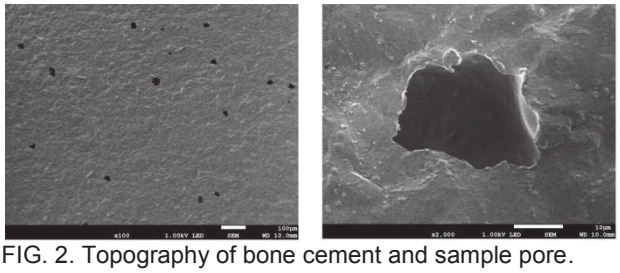

FIG. 2. Topography of bone cement and sample pore.

The average contact angle 61.3° was determined at the moment of falling a drop and next decreased to 58.2° after 5 seconds, and after 10 seconds to 56.7°. A sample test result is shown in FIG. 3.


FIG. 3. Sample contact angle test.

Absorption of the artificial saliva solution by immersion in bone cement samples and retention at 37° were investigated. After 1h the average weight of the samples increased by 0.0034 grams, and after 24 h by 0.0067 grams. The samples were dried for 1 h at 50°C and the hydration degree (Ha) was calculated, by using following Eqs. [6]:

$$H_a\,(\%) = \left(\frac{m_w - m_f}{m_o}\right) x100$$

Calculated the average hydration degree was 0.68% after 24 hours immersion in solution and drying.

A corrosion test was performed in the artificial saliva solution and the average corrosion current was determined to 6.72 A/cm$^2$ and the average corrosion potential was -429.57 V. Comparatively, for titanium samples without bone cements coverage, the average corrosion current was 26,246,72 A/cm$^2$ and the average corrosion potential was -386.5 V. Surface topography (magnification 100x) and pores (magnification 2000x) were observed using the SEM microscope – FIG. 4.

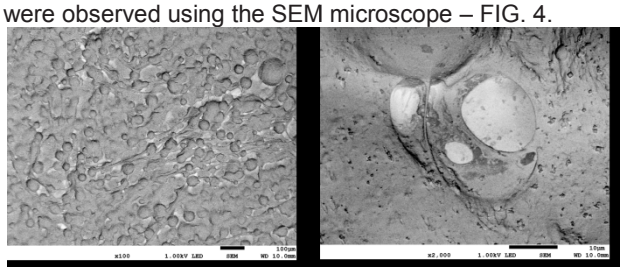

FIG. 4. Topography of bone cement after corrosion test.

## Conclusions

Porous bone cement with a relatively distribution of pores was obtained,
The wetting of the resulting bone cement shows, that it is hydrophilic and will provide adequate adhesion of water, protein and osteoblast, which will allow the osteointegration process,
The water absorption by the bone cement is relatively small after 24 h – Ha=0.68%, which means that there is no loss of mechanical properties due to the presence in the aquatic environment,
The coverage of metal implants with bone cement weakens its corrosion in aggressive environment, but unfortunately the effect of corrosive agents is to "dissolve" the top layer of bone cement.
It is assumed, that bone cement can be used in maxillo-facial surgery.

## References

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