THE 9TH INTERNATIONAL CONFERENCE ON ADVANCED CONCEPTS IN MECHANICAL ENGINEERING

ACME

ADVANCED CONCEPTS in MECHANICAL ENGINEEERING

"GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF IAŞI - FACULTY OF MECHANICAL ENGINEERING

JUNE 04 - 05, 2020, IASI, Romania

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Topics

- Machine Design. Tribology. (Section 1);
- Materials and Surface Engineering (Section 2);
- Mechatronics. CAD. Mechanical Vibrations. (Section 3);
- Theory of Mechanisms and Machinery. Robotics (Section 4);
- Mechanics of Deformable Bodies (Section 5);
- Automotives. Engine and Transmission. Road Safety (Section 6);
- Applied Thermodynamics, Heat Transfer, and Renewable Energy. Thermal Systems (Section 7);
- Technologies in Agriculture and Food Processing (Section 8);

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CONFERENCE PROGRAM

THE 9th INTERNATIONAL CONFERENCE ON ADVANCED CONCEPTS IN MECHANICAL ENGINEERING

ACME2020

JUNE 4 – 5, 2020
IAŞI, ROMANIA

Organized by:

FACULTY of MECHANICAL ENGINEERING

THE "GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF IASI

Under the aegis of:

ROMANIAN MINISTRY OF NATIONAL EDUCATION AND SCIENTIFIC RESEACH
ROMANIAN ACADEMY OF TECHNICAL SCIENCES
ACADEMY OF ROMANIAN SCIENTISTS

In partnership with:

AMERICAN UNIVERSITY OF MADABA, JORDAN
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ART – ROMANIAN TRIBOLOGY ASSOCIATION
SRT - ROMANIAN SOCIETY OF THERMODYNAMICS
AFCR - ROMANIAN ASSOCIATION FOR REFRIGERATION AND CRYOGENICS ENGINEERS

5	2-10	**Morphological and tribological studies of thermal plasma jet deposited coatings used in cardan joints** A Dascălu, B Istrate, C Munteanu, C Paleu Cîrlan, V Paleu	13.00 - 13.15
		Own World Lunch Break	14.00 - 15.00
		POSTER SESSION	
6	2-01	**Analysis of the collapse mode classification in case of circular tubes** C P Predoiu, R F Negrea, S Tabacu, D Popa	15.00 - 15.10
7	2-02	**Ecological process for depositing thin layers with high tribology resistance for reconditioning the hydraulic turbines** C A Tugui, P Vizureanu, N A Danila, M C Perju, D P Burduhos-Nergis	15.10 - 15.20
8	2-04	**Experimental analysis of three tetra-anti-chiral auxetic honeycomb structures** R Negrea, P Predoiu, S Tabacu, D Negrea	15.20 - 15.30
9	2-06	**Fatigue cracks in aluminum alloys structures detection using electromagnetic sensors array** R Steigmann, N Iftimie, G S Dobrescu, A Danila, P D Barsanescu, M D Stanciu, A Savin	15.30 - 15.40
10	2-09	**Contact stress simulation problem in case of the Mg alloys** S Lupescu, C Munteanu, A Tufescu, B Istrate, N Basescu	15.50 - 16.00
11	2-11	**The study of the mechanism interaction between sparks electric discharges and a AISI 316L biocompatible metallic samples** A Piron, F V Anghelina, C Popa, V Despa	16.00 - 16.10
12	2-12	**Theoretical investigation of optical phenomenon from nanometric antireflex layers** A T Pascu, M A Pascu, D Besnea	16.10 - 16.20
13	2-13	**Experimental research and simulation of vibration isolation elements mounted within transport boxes** D Voicu, R M Stoica, R Vilau, L Barothi	16.20 - 16.30
14	2-14	**“In vivo” Analysis of Osteoinduction Treatment on Ti6Al7Nb** V Lucero Baldevenites, N Florido Suarez, P Socorro Perdomo, J Mirza Rosca	16.30 - 16.40
15	2-15	**Microscopic Passivation of Bio High Entropy Alloys: Initial studies** N Florido Suarez, V Lucero Baldevenites, P Socorro Perdomo, I Voiculescu, V Geanta, J Mirza Rosca	16.40 - 16.50
16	2-16	**Electrochemical Behavior of New Titanium Alloys** V Lucero Baldevenites, N Florido Suarez, P Socorro Perdomo, J	16.50 - 17.00

		Mirza Rosca	
17	2-17	**Nanostructurated Ti-20Zr in Artificial Extra-cellular Fluids** V Lucero Baldevenites, N Florido Suarez, P Socorro Perdomo, J Mirza Rosca	17.00 - 17.10

Session ACME-03-01: Mechatronics. CAD. Mechanical Vibrations

Thursday, June 4th, 2020

Chairmen: *Prof. Jose MACHADO* and *Lecturer Vlad CARLESCU*

No.	ACME code	Title of the papers and authors	Hours
1	03-01	**Experimental analysis of vertical vibration of railway bogie** M Dumitriu, I C Cruceanu	12.00 - 12.15
2	03-03	**Designing and testing a stand used to simulate the dummy head impact with different surfaces using CAD software** A I Radu, D D Truşcă, G R Toganel, B C Benea	12.15 - 12.30
3	03-04	**Bearing fault diagnosis using the Kolmogorov-Smirnov test on frequency features extracted using the Goertzel algorithm** D Cordoneanu	12.30 - 12.45
4	03-32	**Arduino based mobile robot controlled by voluntary eye-blinks using LabVIEW GUI & NeuroSky Mindwave Mobile Headset** O A Ruşanu, L Cristea, M C Luculescu	12.45 - 13.00
5	03-06	**Modelling and optimization of dynamic absorber with viscous friction** R Ibănescu, M Ibănescu	13.00 - 13.15
6	03-08	**Determinations regarding the influence of the different elastic systems from the suspension structure of a N2 type vehicle, on the movement and comfort** M F Mitroi, A Chiru	13.15 - 13.30
7	03-12	**Student demonstrator for teaching Brain-Computer Interfaces** A Ianoşi-Andreeva-Dimitrova, D S Mândru, I D Bologa	13.30 - 13.45
8	03-25	**Design, tuning and evaluation of a stand-alone nitinol based thermomechanical actuator driver with a closed-loop position control system** N Popescu	13.45 - 14.00
		Own World Lunch Break	14.00 - 15.00

“In vivo” Analysis of Osteoinduction Treatment on Ti6Al7Nb

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Abstract. The importance of the mechanical stability of one implant is evaluated by analyzing the quality of the osseointegration at the bone-implant interface through the analysis of the amount of neoformed bone in direct contact with the implant, able to mechanically fix the implant and the type of bone tissue that is formed. The study of the in vivo behavior of a Ti6Al7Nb implant, subjected to 2 different surface treatments, is of great interest in order to determine and evaluate the possible TOXICITY caused by the implant through the content of metals present in biological fluids of experimental animals, OSTEOINTEGRATION of the implant and OSTEOINDUCTION at the implant-bone interface. To study the release of ions from the implant (Ti6Al7Nb) to the body (determination of Aluminum toxicity), the Atomic Absorption Spectrometry (EAA) technique has been used.
This technique has been chosen, since they have very good characteristics: high specificity, selectivity, excellent sensitivity at low concentrations (1000 ppm), speed of determination and a wide field of application (70 elements, which makes it the technique). best suited for measuring Aluminum in biological fluids)
For the bone-implant interface study (osseointegration), the Scanning Electron Microscopy technique with EDX analyzer was used.
This new treatment, called SBF (synthetic or simulated body fluids), has the advantage of inducing the formation of apatite (hydroxyapatite coating) in metals and other materials, immersed in solutions that simulate biological fluids (Ringer, Earl, Hanks). The innovation of this treatment is found in the use of biovitroceramic particles as substitutes.

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Keywords:

Titanium, niobium, aluminum, osseointegration, implant, biological fluids

1. Introduction:

The importance of the mechanical stability of one implant is evaluated by analyzing the quality of the osseointegration at the bone-implant interface through the analysis of the amount of neoformed bone in direct contact with the implant, able to mechanically fix the implant and the type of bone tissue that is formed.
The study of the in vivo behavior of a Ti6Al7Nb implant, subjected to 2 different surface treatments, is of great interest in order to determine and evaluate the possible TOXICITY caused by the implant through the content of metals present in biological fluids of experimental animals, OSTEOINTEGRATION of the implant and OSTEOINDUCTION at the implant-bone interface.

2. Experimental Part:

To study the release of ions from the implant (Ti6Al7Nb) to the body (determination of Aluminum toxicity), the Atomic Absorption Spectrometry (EAA) technique has been used.
This technique has been chosen, since they have very good characteristics: high specificity, selectivity, excellent sensitivity at low concentrations (1000 ppm), speed of determination and a wide field of application (70 elements, which makes it the technique). best suited for measuring Aluminum in biological fluids)

For the bone-implant interface study (osseointegration), the Scanning Electron Microscopy technique with EDX analyzer was used.

3. Results and Discussions:

The area known as the tip-plate was analyzed by means of a 1.5 mm scan, collecting points, as in the other cases, from the bone part, the bone-metal interface and the metal.
Likewise, the interface was carefully examined in order to find out if there is metal contamination in the bone-organic structure.

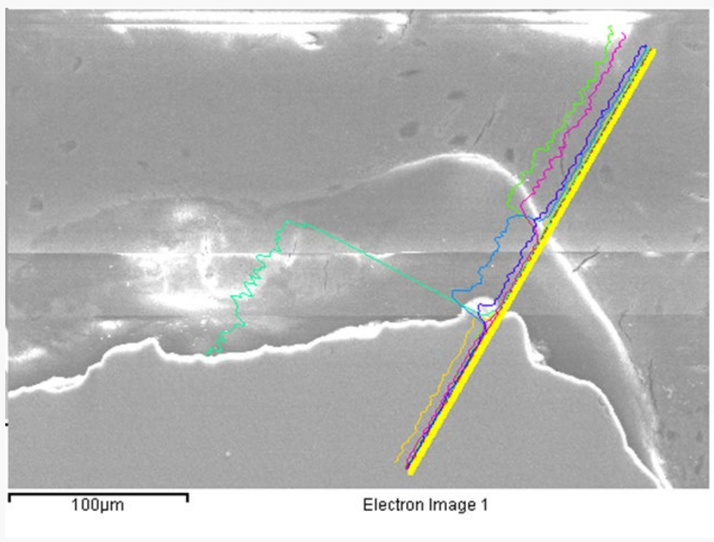

Figure 1. Análisis interfaz hueso-implante en la zona de la punta-placa mediante barrido de 1.5 mm

This new treatment, called SBF (synthetic or simulated body fluids), has the advantage of inducing the formation of apatite (hydroxyapatite coating) in metals and other materials, immersed in solutions that simulate biological fluids (Ringer, Earl, Hanks). The innovation of this treatment is found in the use of biovitroceramic particles as substitutes.

In order to demonstrate the feasibility of this treatment in medical applications, it was evaluated in vitro through its application to implants.

Biocompatibility analyzes consisted of in vitro assays of osteoblastic cells (osteoblast culture) donated by the American Type Culture Collection. Osteoblastic cells were grown with an initial density of 1x104 cell · cm^{-2} in a medium consisting of a 1:1 mixture of Dulbecco's modified Eagle's medium and Ham's F12 medium containing 0.3 mg/ml G418, 10% fetal bovine serum, 100 U/ml of penicillin and 100 g/ml streptomycin, in a humid atmosphere and 5% CO_2.

Depending on the incubation temperature, the cell culture can show similar preosteoblastic characteristics.
Analyzes of the surface of the implants at the microstructural level, as well as the XRS patterns are shown below.

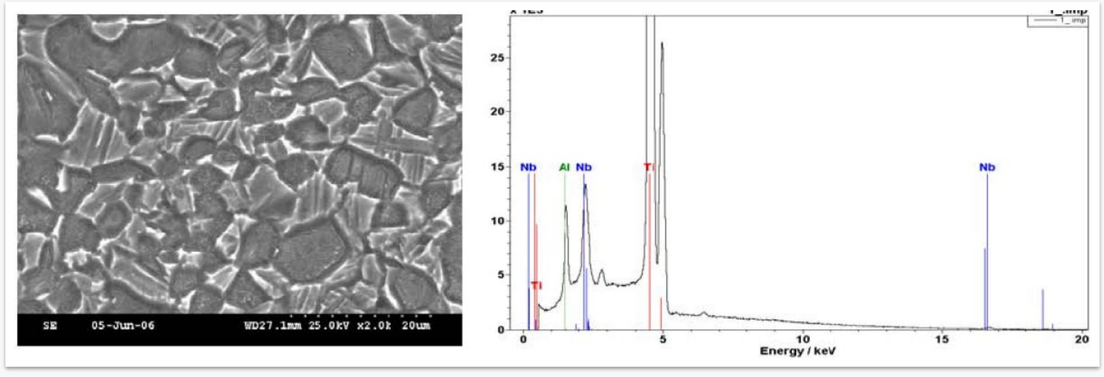

Figure 2. De izq. a der. se muestra la superficie del Ti6Al7Nb y el patrón XRD.

In the image of the Ti6Al7Nb microstructure, the primary grains of the metastable phase are observed and the graph shows the characteristic peaks of the Ti6Al7Nb alloy.

4. Conclusions:

In vitro tests, treatement superficial SBF with biovitroceramic particles to the implants indicate that there is good osteoinduction and biocompatibility in the samples, highlighting immersion time as an important parameter in deposition quality (biocompatibility and cytotoxicity): expression of alkaline phosphatase confirms that osteoblastic cells belong to the osteoblastic phenotype, existing positive histochemical reaction; Cytomorphological analyzes show differences related to the start of the culture: after 24 hours, results are better for samples immersed for 15 days; after 48 hours, results are better for samples immersed for 15 days.

Studies using the EAA technique indicate that the concentration of Al that can affect humans due to the diffusion of Al by wearing an implant is insignificant, and cannot be considered harmful compared to daily consumption due to food intake or other factors.

This last conclusion collides with the arguments found in the existing literature that bet on a change in the implantable material, that is, a change in the widely used Ti6Al4V alloy with satisfactory results for the Ti6Al7Nb alloy object of this study, much more expensive and difficult to obtain

5. Acknowledgments:

We appreciate the support and generosity of ITC (Instituto Tecnológico de Canarias) Las Palmas, Spain, without which the present study could not have been completed.

References:

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