EFC Event number 459

The annual event of the European Federation of Corrosion **EUROCORR 2020**

Closing the gap between industry and academia in corrosion science and prediction

EUROCORR The European Corrosion Congress

Organized by

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The main topic will be: "Closing the gap between industry and academia in corrosion science and prediction."

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6-10 SEPTEMBER 2020

BELGIUM, BRUSSELS

SQUARE – BRUSSELS MEETING CENTRE

Your submission for EUROCORR 2020: Paper-ID 310685

Julia Claudia Mirza Rosca <julia.mirza@ulpgc.es>

Mié 05/08/2020 10:54

Para: LUCERO BALDEVENITES <viviana.lucero@ulpgc.es>

Dra. Julia Claudia Mirza Rosca
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DE GRAN CANARIA

De: eurocorr@dechema.de <eurocorr@dechema.de>
Enviado: miércoles, 22 de julio de 2020 18:45
Para: Julia Claudia Mirza Rosca <julia.mirza@ulpgc.es>
Asunto: Your submission for EUROCORR 2020: Paper-ID 310685

Dear Ms Julia Mirza Rosca,

Thank you for your abstract submission!
You will be informed after 30th April 2020 about the acceptance.

About your paper

Paper-ID: 310685
Paper title: Titanium-Tantalum alloys with bioactive surface for orthopaedic implants
Desired presentation format: "Poster"
Topic: "Corrosion Mechanisms, Methods and Modelling (3M, WP6 + 8)"

I will give an oral talk and I'm younger than 35 years (information needed for participation in the best young speakers competition of all the sessions (two prizes) and of Working Party 4 'Nuclear Corrosion' (one prize)): **No**

The following authors have been registered:

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Your submission:

Achieving a stable bone-implant interface is an important factor in the long-term outcome of joint arthroplasty. It was demonstrated that the bone-bonding ability of a material could be evaluated by testing the materials in a simulated body fluid (SBF) and in these conditions, the capability of forming hydroxi-apatite on the surface of the material has been considered to indicate its bone-bonding potential.

The paper focus on the study of the bone-bonding capability of three new titanium alloys with 5%, 15% and 25%Ta which were soaked in 10M aqueous NaOH solution then were immersed in a simulated body fluid (SBF). The materials were studied before and after the immersion by optical metallography, microhardness, open circuit potential and electrochemical impedance spectroscopy.

The methallographical aspects of the samples surfaces after alkali-treatment and before immersion in SBF demonstrated the presence of two phases: one soft and one hard. The same results were obtained by microhardness surface scanning. The open circuit potential shows a good stability of the alloys in SBF.

Analysis of the impedance spectra was done using the Boukamp nonlinear least square fitting procedure. The EIS spectra exhibited two-time constant system suggesting the formation of a two-layer oxide film on the alloys surface, i.e. a porous outer oxide and a barrier inner oxide.

It is therefore expected that the new Ti-Ta alloys subjected to this appropriate treatment could form an apatite layer via TiO_2 gel formation on their surface in the body’s environment, and bond to living bone through the apatite layer.

Kind regards

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Titanium-Tantalum alloys with bioactive surface for orthopaedic implants

E.V. Lucero Baldevenites[1], J.C. Mirza Rosca[1], N.R. Florido Suárez[1],
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It is therefore expected that the new Ti-Ta alloys subjected to this appropriate treatment could form an apatite layer via TiO_2 gel formation on their surface in the body's environment, and bond to living bone through the apatite layer.

Keywords: Ti-Ta; Metal alloys; Metallographic characterization, Microhardness, Orthopaedic; Open circuit potential; Biocompatibility; Simulated body fluid

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Universitatea TRANSILVANIA din Braşov

TITANIUM-TANTALUM ALLOYS WITH BIOACTIVE SURFACE FOR ORTHOPAEDIC IMPLANTS

E.V. Lucero Baldevenites[1], J.C. Mirza Rosca[1], N.R. Florido Suárez[1], P.P. Socorro Perdomo[1], A. Pascu[2], E. Stanciu[2]

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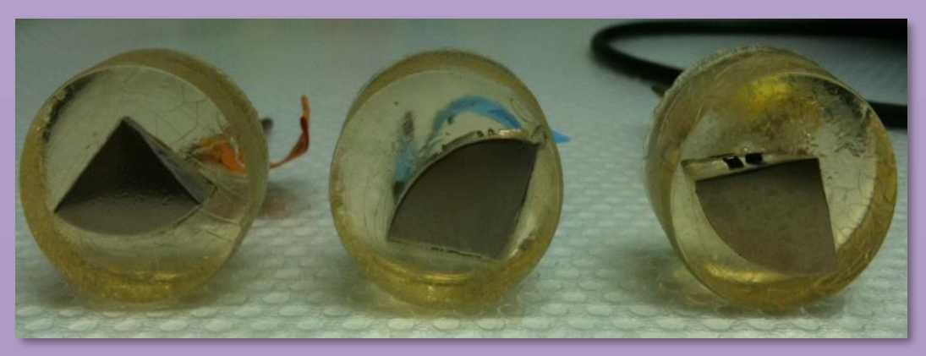
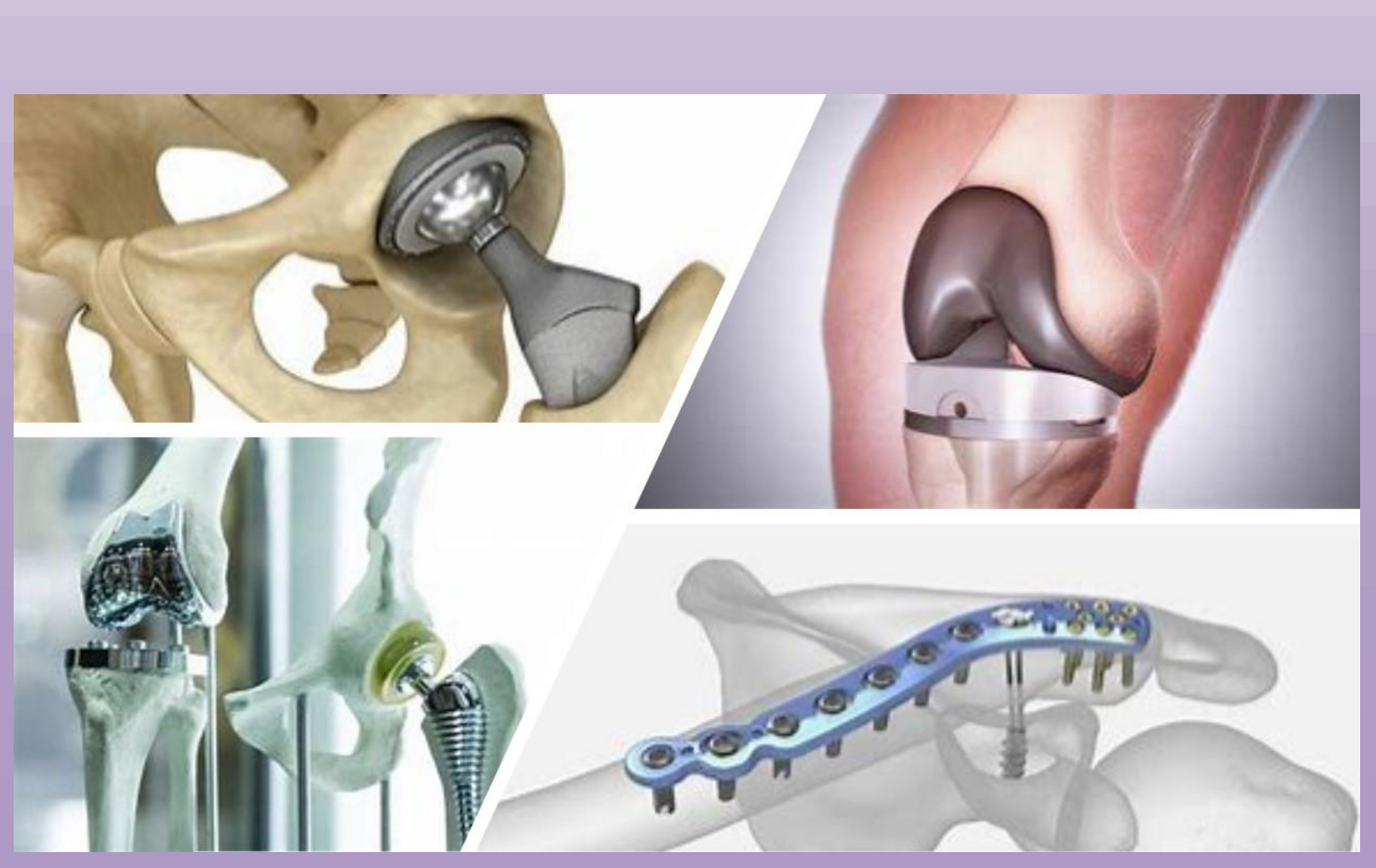
MATERIALS

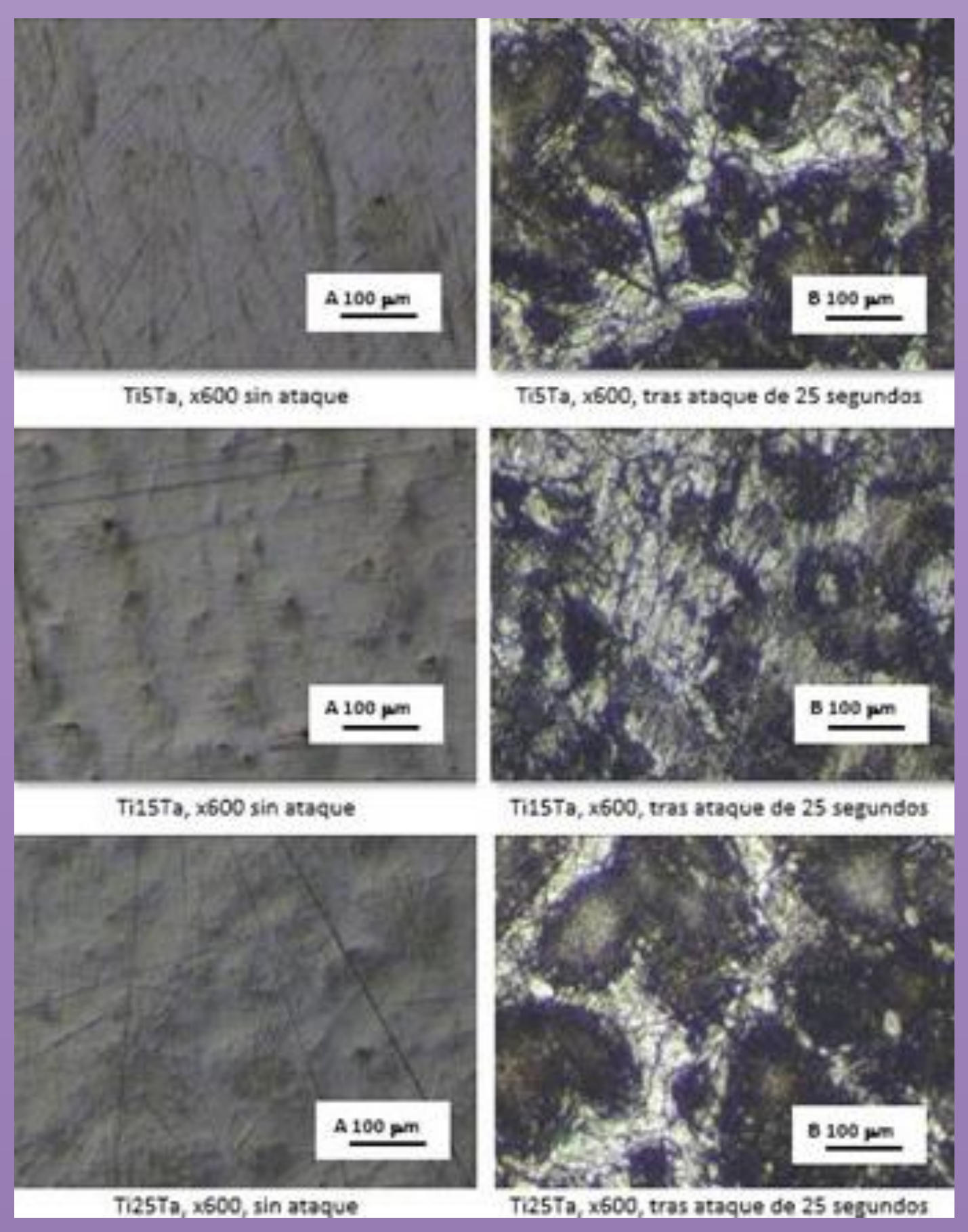


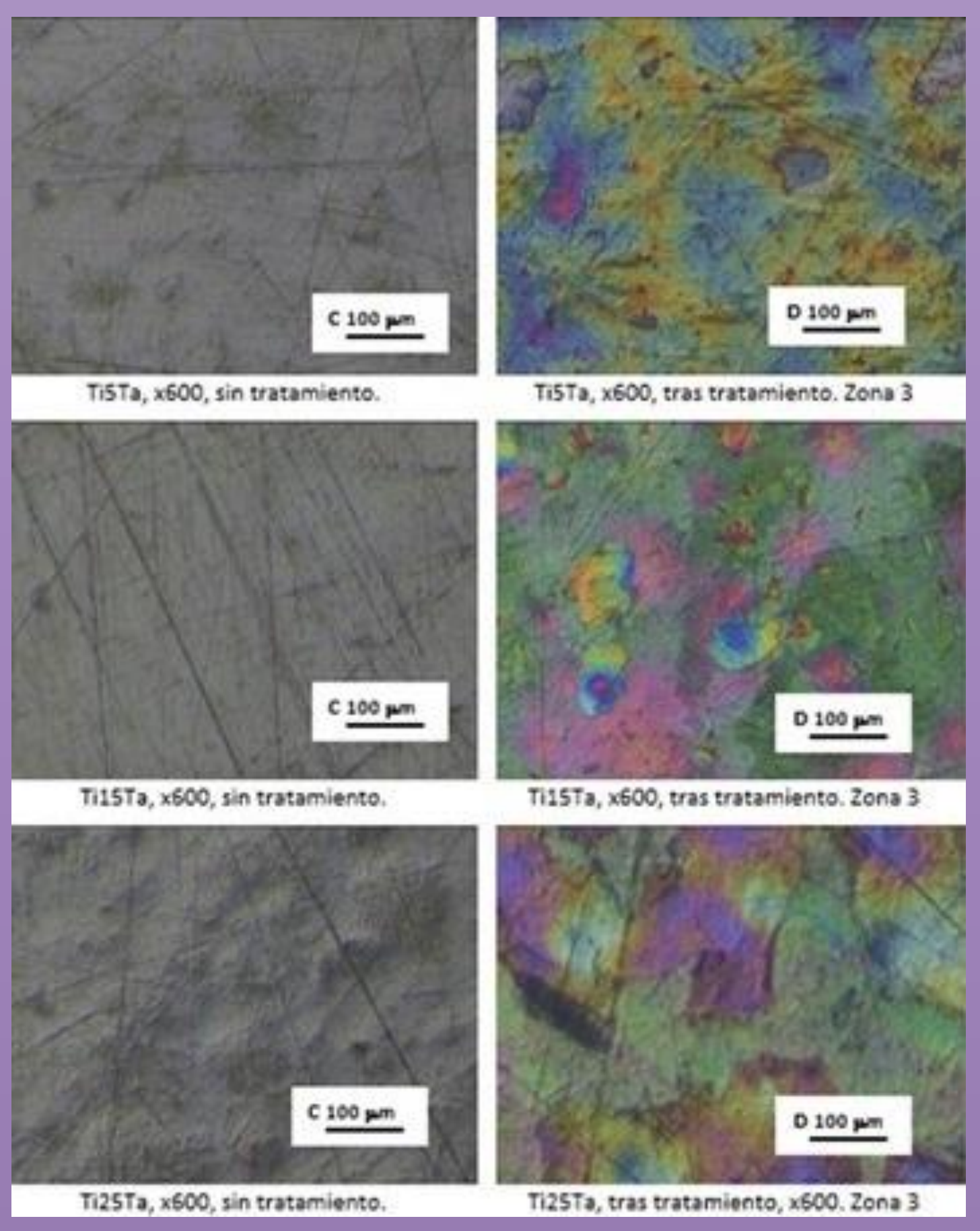
Alloy	Components	Composition by weight (wh%)	
		Weighted	Measured
Ti5Ta	Ti	95,0	95,0
	Ta	5,0	5,0
Ti15Ta	Ti	85,0	84,8
	Ta	15,0	15,2
Ti25Ta	Ti	75,0	74,6
	Ta	25,0	25,4



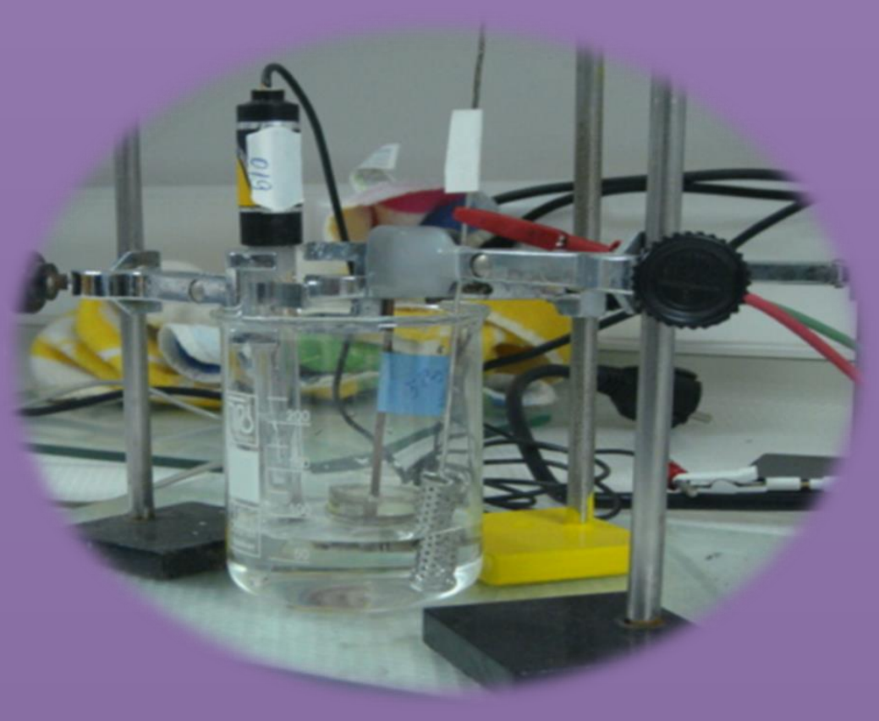
METHODS

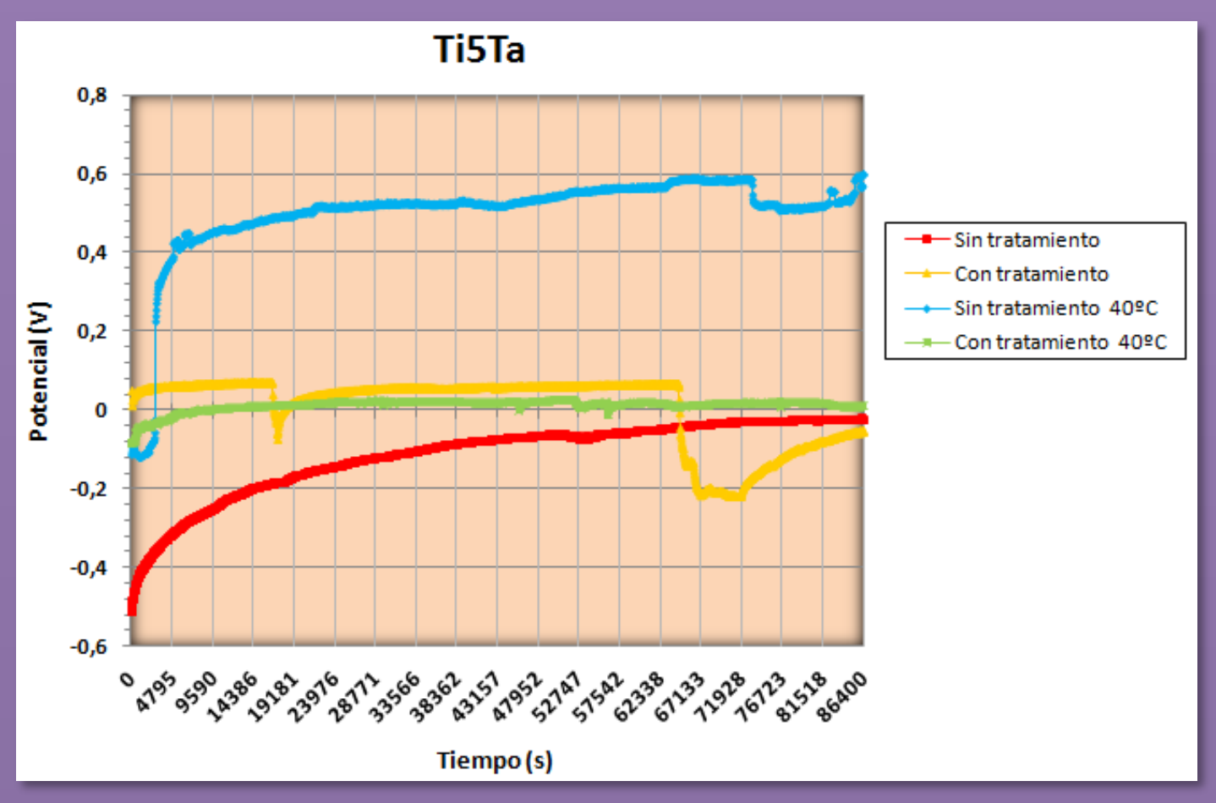
METALLOGRAPHIC ANALYSIS

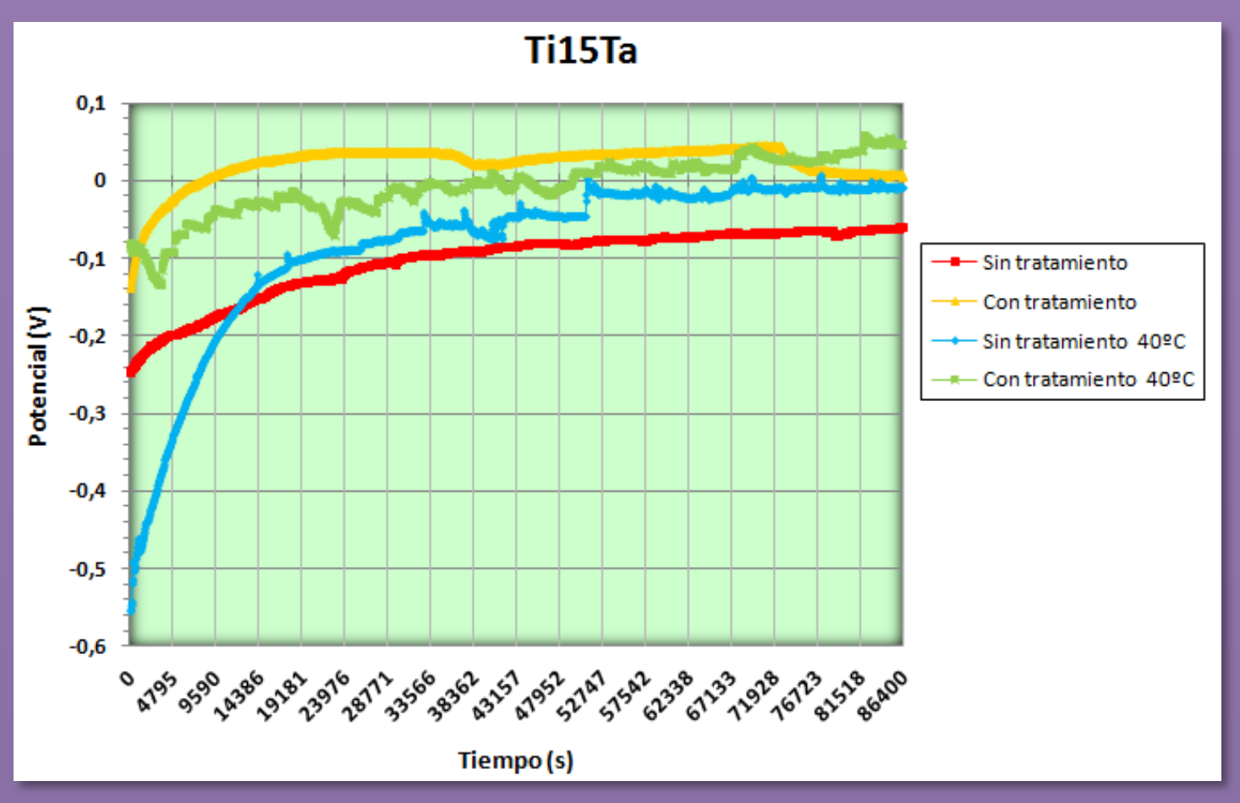


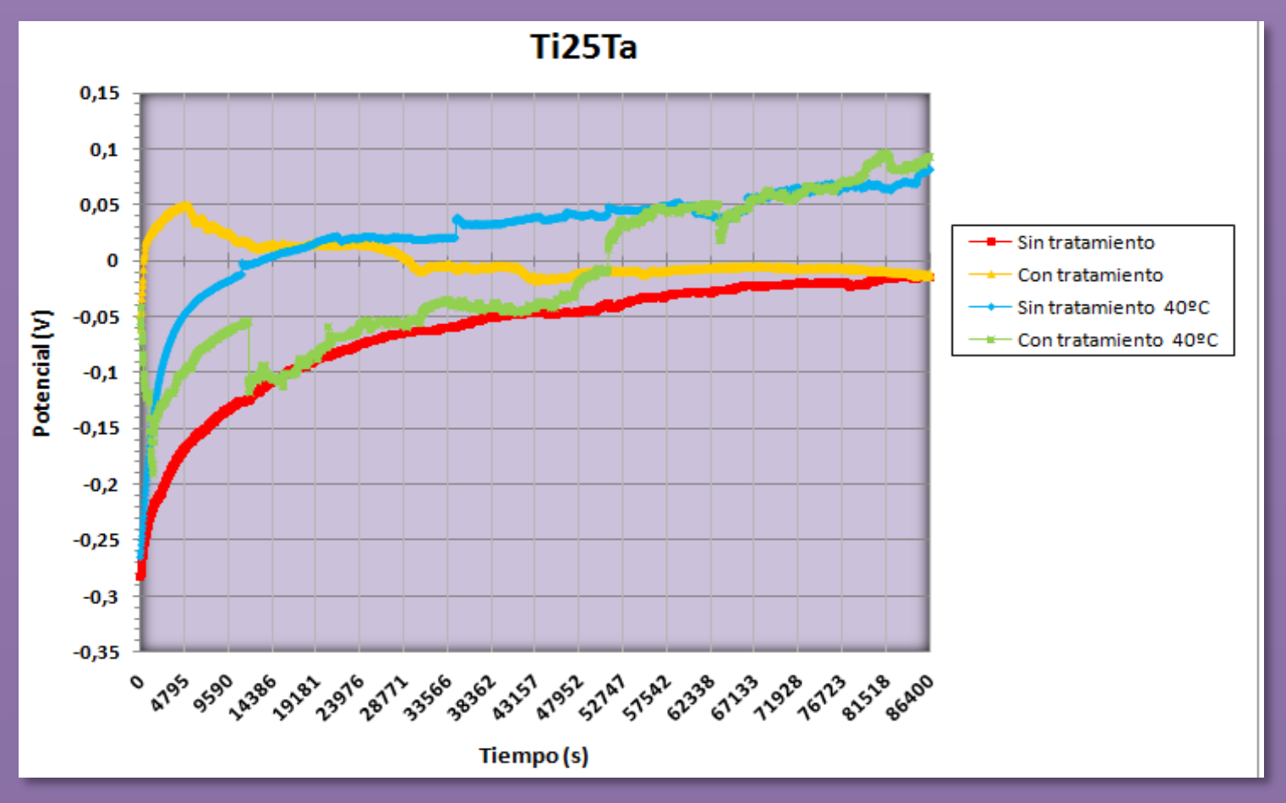


OPEN CIRCUIT POTENTIAL

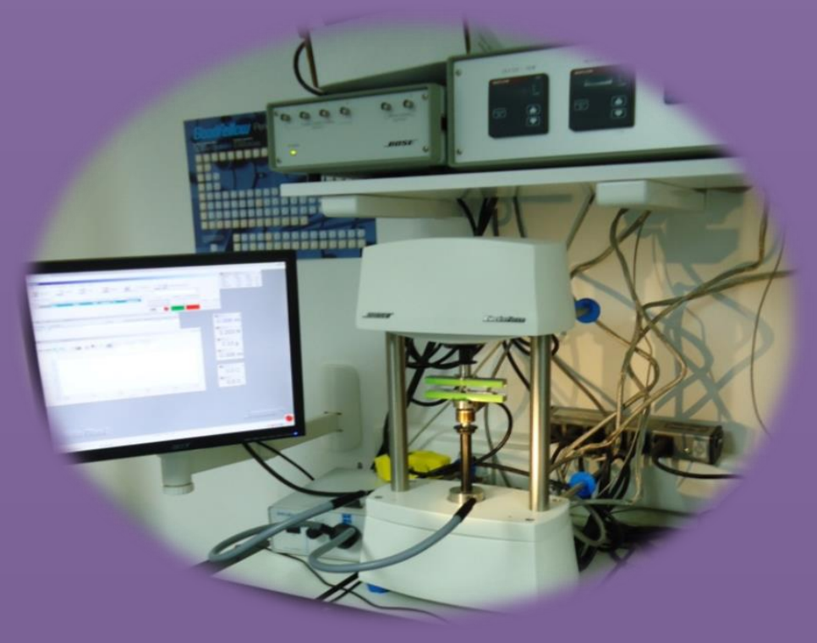


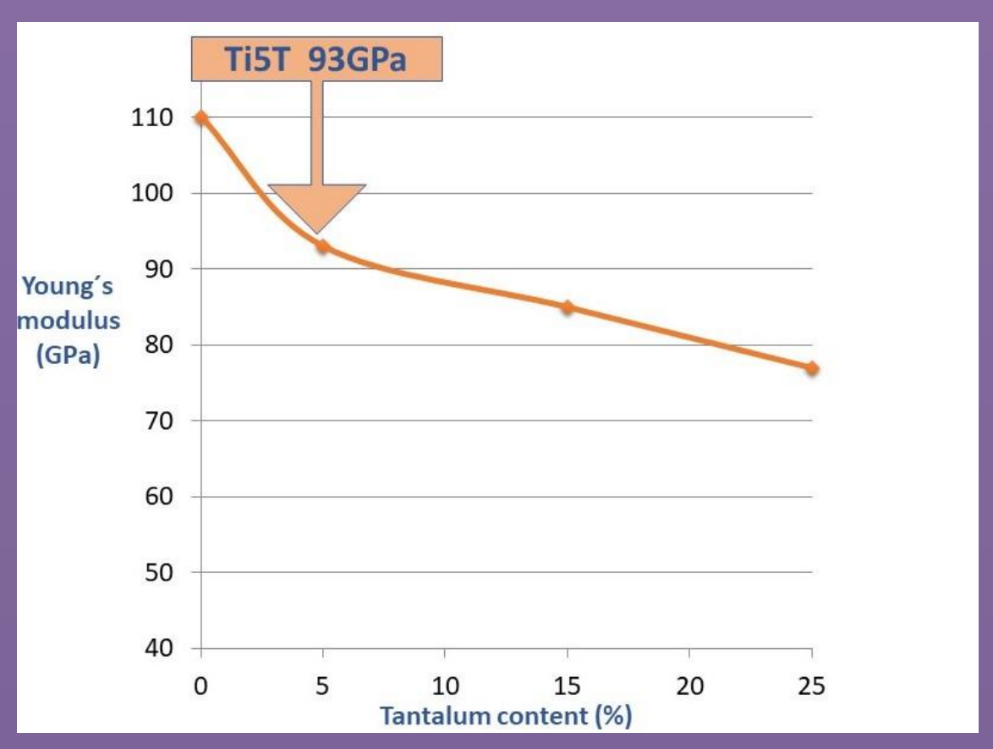


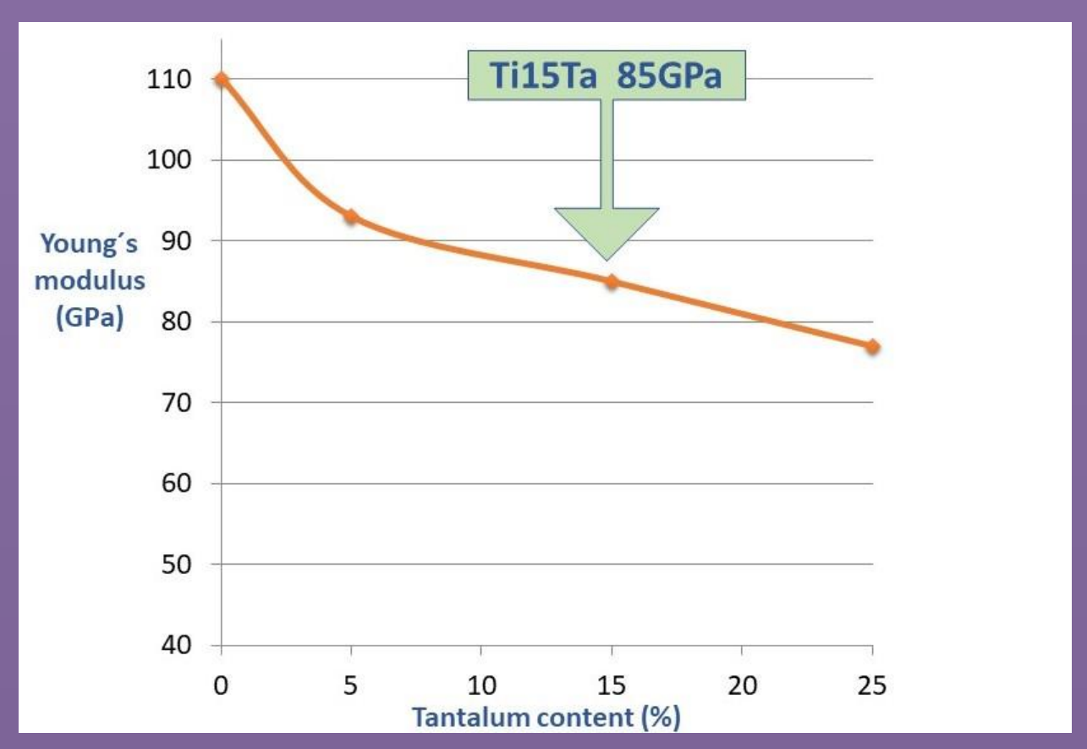


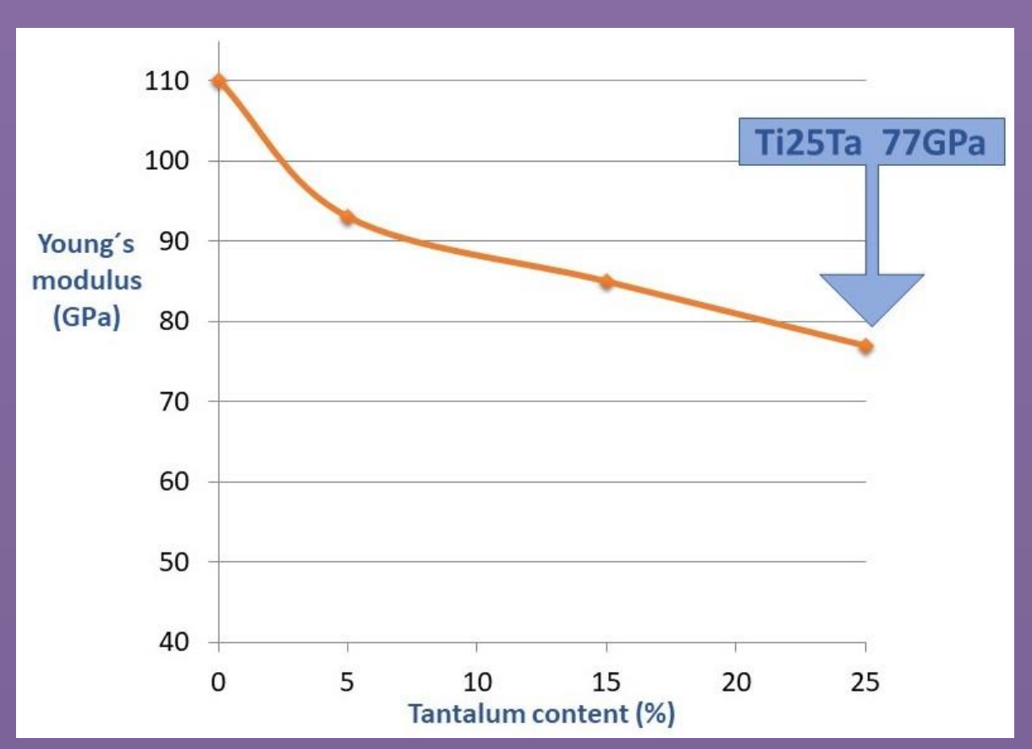


THREE POINT BENDING TEST



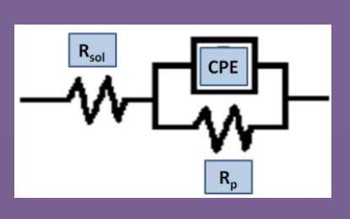


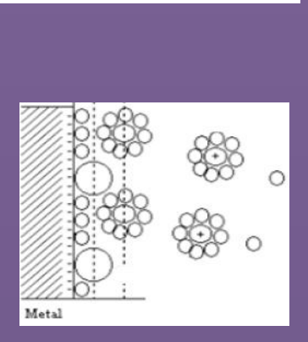


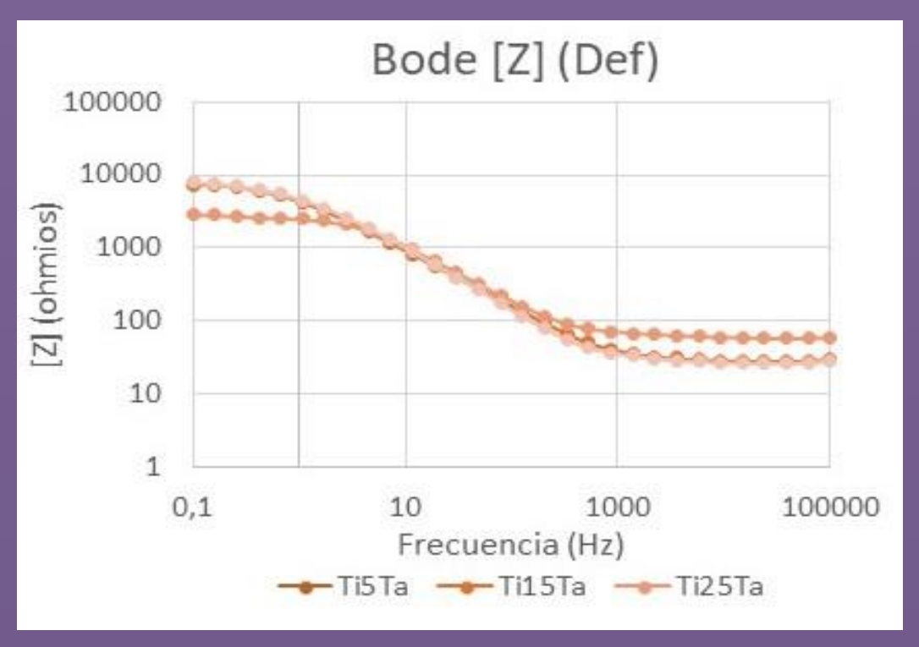


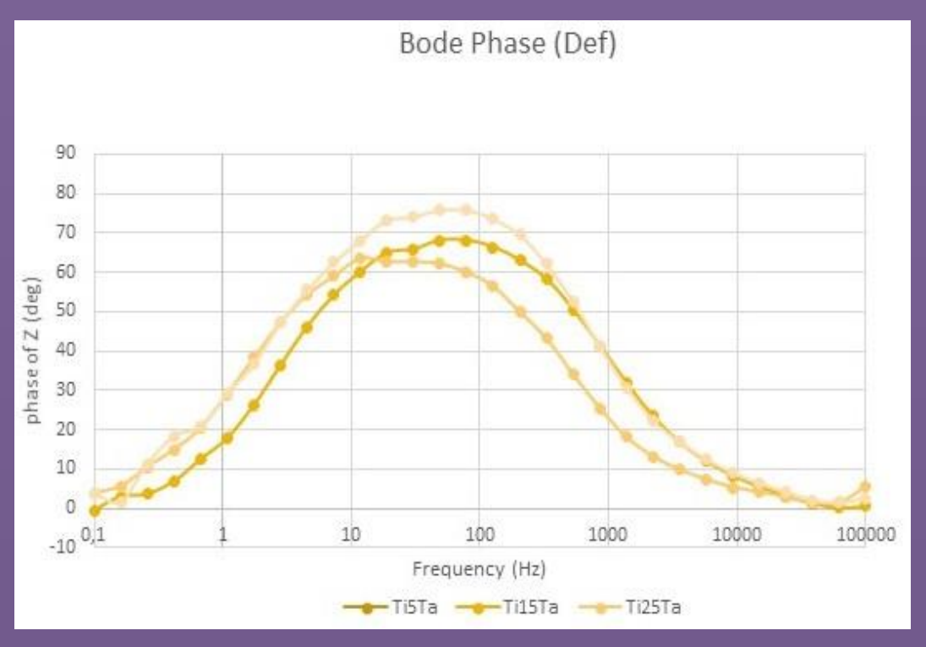
ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY

Alloy	Potential [V]	R_{sol} [Ω.cm²]	Yo_1 [F/cm²]	n_1 [0<n<1]	R_p [Ω.cm²]	Error
Ti-25%Ta	-0,4	38,47	0,000141	0,856	1,4320	1,68E-3
	-0,3	38,38	0,0001347	0,8564	19830	1,24E-3
	-0,2	38,26	0,0001113	0,8667	19270	2,51E-3
	-0,1	38,24	0,0001064	0,8713	19210	2,85E-3
	0	38,33	9,252E-5	0,8861	14530	1,84E-3
	0,1	38,71	7,763E-5	0,9097	9817	9,00E-4
	0,2	38,75	7,117E-5	0,9174	9622	8,59E-4
	0,3	38,77	6,749E-5	0,9197	9959	9,02E-4
	0,4	38,77	6,676E-5	0,9171	10440	9,16E-4
	0,6	39,57	5,829E-5	0,9233	8071	1,13E-3
	0,8	39,47	5,041E-5	0,915	8850	1,42E-3
	1,0	39,25	4,701E-5	0,9051	9090	1,13E-3
	1,2	39,15	4,298E-5	0,9025	7115	1,10E-3









According to microstructure tests result, two crystal structures were observed, a hard one and a soft one. An increase of tantalum content has an effect on increasing material hardness.

Young´s modulus and mechanical properties of TiTa alloys greatly depend on tantalum content, resulting in much lower Young´s modulus than pure titanium.

The open circuit potential of the TiTa alloys stabilizes at a value after a certain period of inmersion in the Ringer´s solution. This phenomenon is due to the rapid formation of the TiO_2 and Ta_2O_5 passive layer and its stabilization.

EIS was used to investigate the corrosion resistance of TiTa alloys, all alloys presented a capacitive behavior, typical of passive systems. Corrosion resistance best results were obtained by the TiTa alloy with the highest tantalum content.

TiTa alloys studied have excellent biocompatibility and corrosion resistant which suggest great possibilities in biomechanical applications.