Titanium peptide coatings for bioactivity and drug delivery
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Titanium and its alloys are biomaterials widely used for medical devices due to their great mechanical characteristics. But to enhance characteristics such as drug delivery or bioactivity, Ti6Al4V can be functionalized with peptides

Titanium 6 aluminium 4 vanadium (Ti6Al4V) adding manufactured
Titania gel and titanium oxide crystals

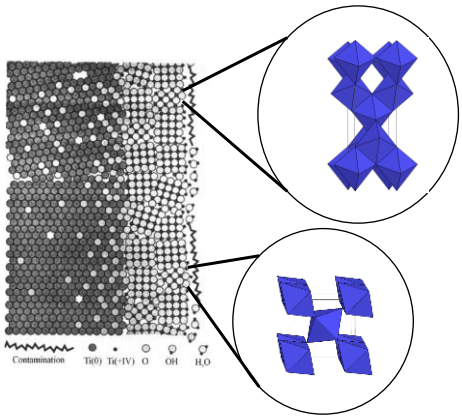
1) Rutile
2) Anatase

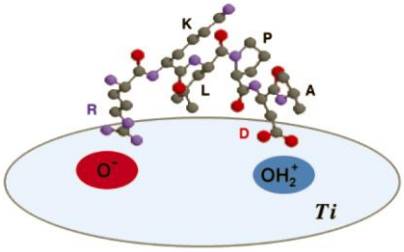
Peptide aptamer

KKLPDAKKLPDA-EEEEEEEE

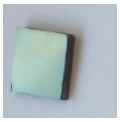
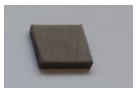
Lysine (K), Leucine (L), Proline (P), Aspartic acid (D), Alanine (A),
Glutamic acid (E)
Positive charge amino acids K
Negative charge amino acids D, E

Titanium reacts with H_2O_2 to increase the hydroxyl groups on the surface and to form a titania gel layer capable of reacting actively with biomolecules. This research focuses on increasing the electrostatic interaction between functional peptides and chemically and thermally treated Ti6Al4V.

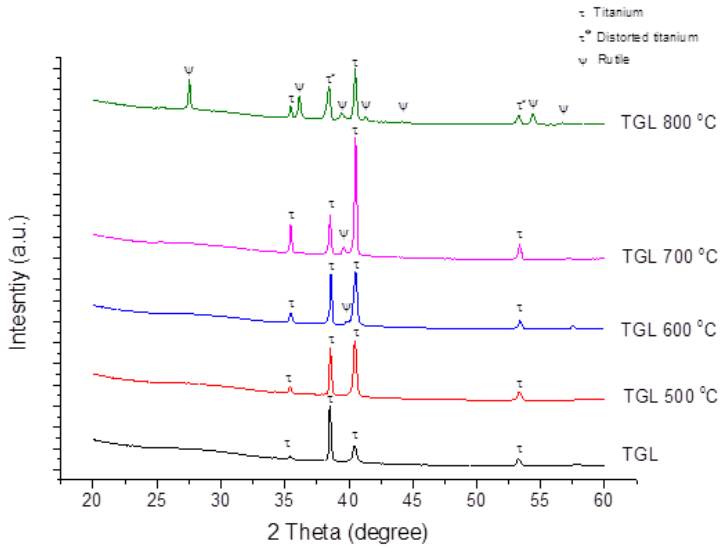




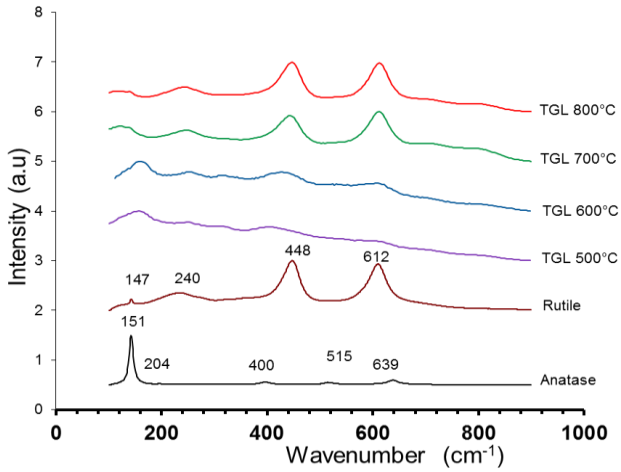
Different surfaces were chemically and thermally treated. What is the composition of each surface ? and Which configuration shows better peptide adsorption?

TGL	TGL 500 °C	TGL 600 °C	TGL 700 °C	TGL 800 °C
				

The surface XRD characterization shows differences with the increase of temperature. Around 600 °C rutile a crystal of titanium oxide starts to appear and at 800 °C rutile is the dominant crystal.



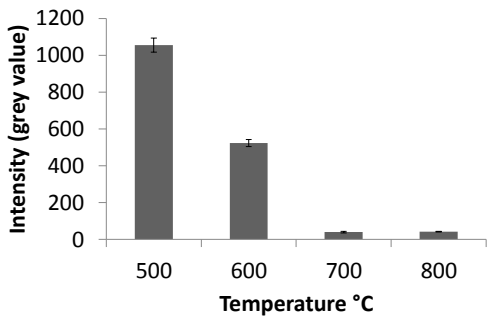
By Raman spectroscopy is possible to visualise more differences in the samples treated at low temperatures. The vibrational states of titanium oxide are seen in all the spectrums. At 500 °C some peaks can be appreciated at low intensity close to the vibrational state of anatase. This is the first evidence of anatase on the titanium surfaces.

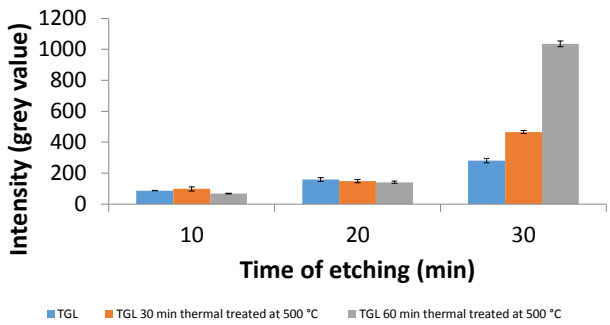


The roughness and thickness show the alterations due to the chemical and thermal treatments. At high temperatures the surfaces present larger roughness than the surfaces exposed at low temperatures. The oxides thickness on the surfaces at low temperatures are thin and difficult to characterized.

	AFM	**Ellipsometry**
Sample name	RMS (nm)	Thickness (nm)
Titania Gel	17	72 ± 2
Titania gel 500 °C	26.7	72 ± 7
Titania gel 600 °C	28.2	84 ± 2
Titania gel 700 °C	69.2	--
Titania gel 800 °C	151.4	--

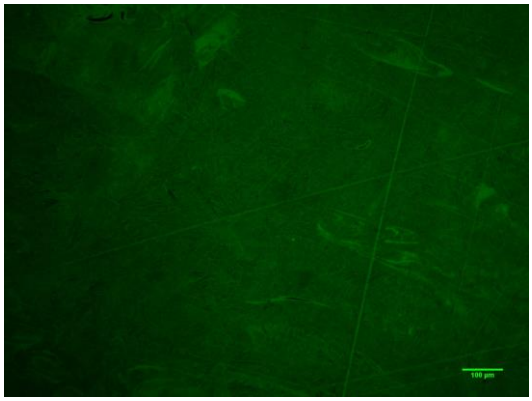
All the surfaces coated with KKLPDAKKLPDAEEEEEEE peptide show highest adsorption on thermally treated samples at 500 °C.





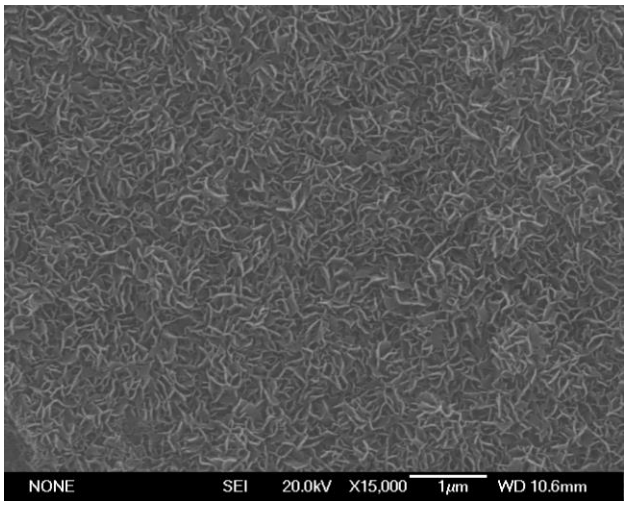
The peptide coating on Ti6Al4V chemical and thermal treated at 500 °C is detected by fluorescence microscopy.

Control



Peptide coated sample

Hydroxyapatite coatings on the surfaces functionalized with peptides were obtained via SBF. The interaction is being study at the moment.



Coatings characterizations are still running

1) Zeta potential with the partner in France
2) Kinetics Raman with the partner in France
3) AFM force repulsions and attraction forces at nano level
4) Contact angle differences on the surfaces with ant without coatings
5) Bioactivity with the partner in Australia