Chemical Element Analysis with ICP OES for Biotechnical Materials at IFW Dresden

Institute of Complex Materials (IKM), Department Chemistry of Functional Materials

Investigations

Infuence of element concentration to material properties

Monitoring of steps of synthesis route to optimize procedures

Precision analysis of new materials

Determination of element concentration of educts to calculate charge of material synthesis

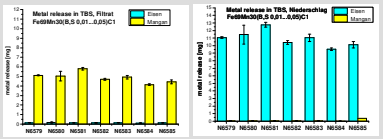
Biodegradable Fe-Mn-C-alloys for medical applications

Characterization of alloys after melting and casting process

name of alloy		N6579	N6580	N6581	N6582	N6583	N6584	N6585
Fe [wt%]	target	69	68,99	68,97	68,95	68,99	68,97	68,95
	as-is	68,47	69,16	68,73	68,97	68,48	69,25	68,97
		RSD=0,23%	RSD=0,17%	RSD=0,21%	RSD=0,36%	RSD=0,21%	RSD=0,17%	RSD=0,20%
Mn [wt%]	target	30	30	30	30	30	30	30
	as-is	30,36	29,66	30,35	30,06	30,19	29,65	29,76
		RSD=0,53%	RSD=0,19%	RSD=0,41%	RSD=0,47%	RSD=0,28%	RSD=0,23%	RSD=0,23%
B [wt%]	target		0,01	0,03	0,05			
	as-is		0,01	0,28	0,048			
			RSD=2,86%	RSD=3,42%	RSD=5,50%			
S [wt%]	target					0,01	0,03	0,05
	as-is							

Metal release studies in a physiological electrolyte

Electrolyte:
TBS...Tris-Buffered Saline, Fa. Sigma Aldrich, 150 mM NaCl, ~ 0,9% NaCl
pH 7,6, TBS, 37°C, static, ratio ml electrolyte/ cm² sample surface: 225
according J. Levesque et al. Acta Biomaterialia 4 (2008) 284 - 295



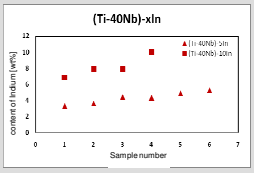
Titanium alloys for biomedical application

Ti-40Nb samples with 5 and 10 wt% Indium addition were produced by casting and solution annealing.

Indium characteristics:

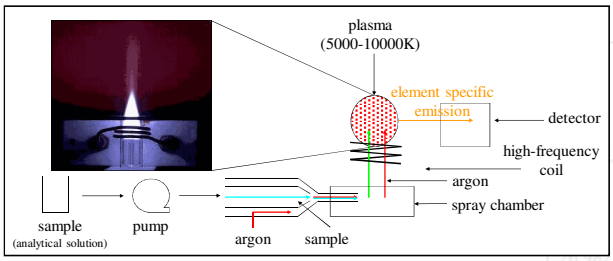
- good biocompatibility
- low Young's modulus,11 GPa (Ti 109 GPa, Nb104 GPa)
- low melting point (157°C)

Indium loss was observed during metallurgic processing. The chemical analysis was very important for optimization of the casting process. The repeatability of chemical composition was improved.



SFB/TR 79
Materials for hard tissue regeneration in systematically diseased bones
BioTiNet
Marie Curie ITN 264635
Academic-Industrial Training Net-work on Innovative Biocompatible Titanium-based Structures for Orthopaedics

Method



ICP-OES schema

Experiences

digestion methods

semi-quantitative survey analysis

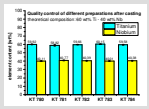
quantitative precision analysis of main components

trace element analysis

layer and composite analysis

Bioactivation of modern implant material based on TiNb

Characterization of TiNb-alloys

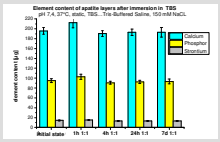


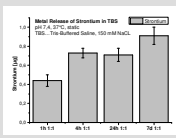
Characterization of Sr-doted apatite layers on TiNb-alloys

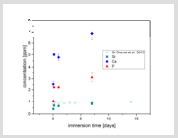
	Ca [µg]	P [µg]	Sr [µg]	ratio Ca+Sr : P
random1	5,06	3,19	0,17	1,64
random2	4,98	3,15	0,17	1,63
random3	4,64	2,88	0,15	1,66
random4	4,86	3,06	0,16	1,64
Average	4,89	3,07	0,16	1,65
SD	0,19	0,14	0,010	0,012
RSD	3,8	4,5	6,4	0,72

Theoretical ratio Ca:P in hydroxylapatit: 1,67

Sr-release studies







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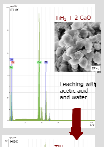
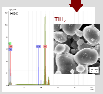
Developement of new synthese route to produce titanium for biotechnical application with a high purity





shaker mill and heat treatment

$TiO_2 + 2\,CaH_2 \rightarrow 2\,CaO + TiH_2 + H_2$

$TiH_2 \rightarrow Ti + H_2$ pure titanium

cleaning process

Quantification by EDX is not possible because of detection limit

Investigations by ICP-OES

Determination of impurities by milling process

	mixture of educts (1) TiO_2/CaH_2	mixture of educts (2) TiO_2/CaH_2	product after milling TiH_2/CaO	cleaning I e	cleaning II ef	cleaning III esf
Fe (wt%)	0,015	0,01	0,58	0,02	0,07	0,01

Determination of cleaning progess (leaching of CaO) by different methodes

	cleaning I e	cleaning II ef	cleaning III esf	cleaning IV eefe
Ca [wt%]	1,2	1	0,70	0,08

Leibniz Association

Leibniz Institute for Solid State and Materials Research Dresden