

THE GLOBAL
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MTT TECHNOLOGIES GROUP

Using SLM-Technology in the Medical
Field
Applications and Solutions



ANY MARKET. ANY TIME. ANYWHERE.

Prepared by S.Ritt September 2009

www.mtt-group.com

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MTT TECHNOLOGIES GROUP

since
2008

Formerly known as

HEK GmbH,



or



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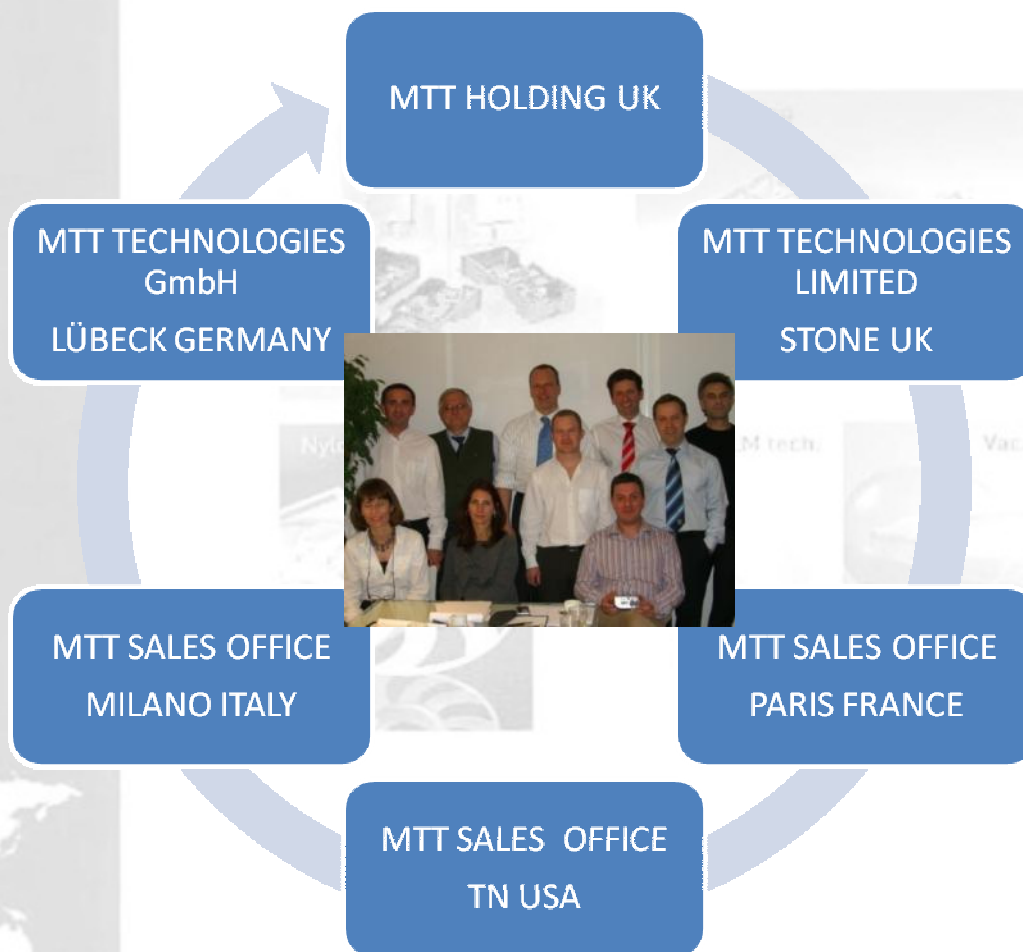


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COMPANY STRUCTURE



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Global Network of Agencies

Germany



France, Italy, Spain, UK



Japan



Brazil



USA



Poland



Australia

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And many, many more..... www.mtt-group.com

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Company key facts

- *Over 50 years of market knowledge*
- *25 Million Euros anual turnover*
- *100 empolyees in Europe*
- *2 factories and 3 own sales offices*
- *100 + sold machines every year*
- *Market base of more than 2500 machines*
- *More than 300 tons of consumables sales per year*
- *Steady technological developments and inventions since 5 decades*



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Technology Landmarks in History in view of our business sectors

- 6000 years ago - Metal casting with lost wax core
- 1907 First plastics developed (BAKELIT)
- 1920 Bismuth alloys used for sheet metal press tools
- 1935 Injection moulding machines for production
- 1950 Metal spray systems developed
- 1960 Vacuum casting in soft tools developed
- 1969 First flight to the moon
- 1983 Motorola makes first portable phone
- 1985 Personal computers, first Portables, MS-Windows
- 1986 First RP-Printing machine from 3 D systems
- 2000 Metal RP-machines get into market
- 2010 Multi-Material Metal RP-machines expected in market



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Historical Time Line

- **1863**
- The Aramayo family founds the company in Bolivia
- **1957**
- Merging of MCP & HEK GmbH
- **1960**
- Development of various applications for Bismuth alloy tooling , sheet metal, inj.molding
- **1970**
- Introduction of metal arc spray systems for tooling applications
- **1980**
- Introduction of Vacuum casting systems into Europe and US
- **1990**
- Vac.Metal Part casting and Nylon vacuum casting invention and patents
- **2000**
- SLM – Selective Laser Melting introduction and global distribution
- **2007**
- MCP HEK Tooling GmbH listed
- **2008**
- MTT GROUP is formed
- **2010**
- Largest portfolio of generative metal production machines, largest build volume SLM machine

**STEADY INVENTIONS AND INNOVATIONS SINCE
HALF A CENTURY !**

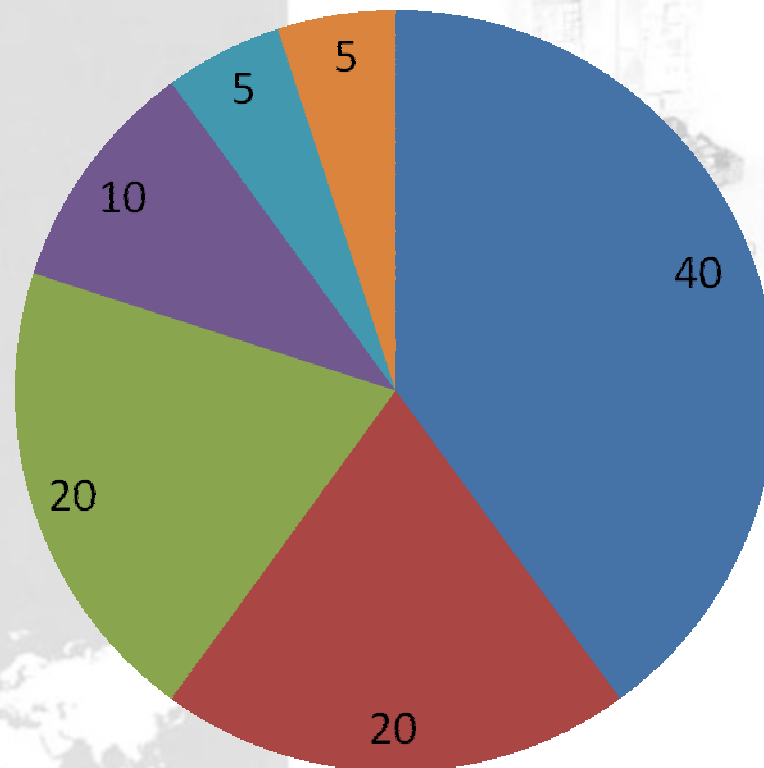
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Average Customer Base



- Automotive
- Home appliances
- Consumer electronics
- Medical
- Aerospace
- Others



„Everything turns around the customer“

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Selective

Laser

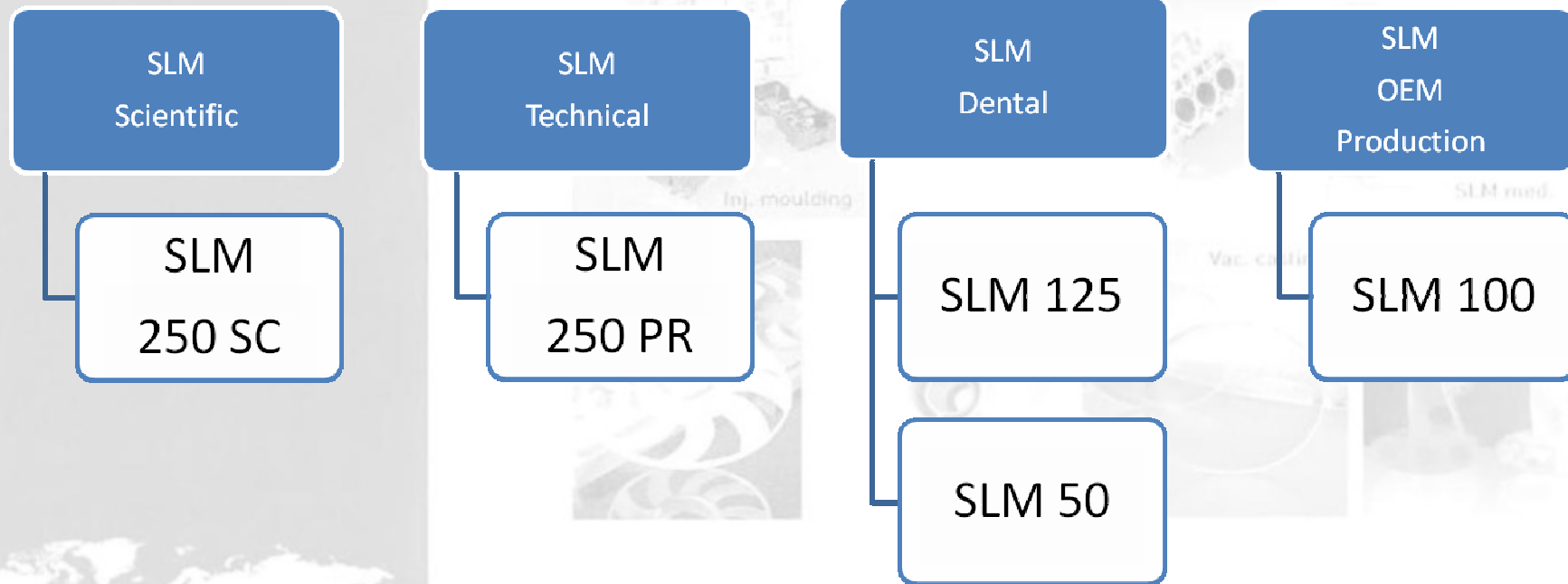
Melting

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PRODUCT PORTFOLIO



Generative Metal Processes



Biggest Variety of Selective Laser Melting Machine Models

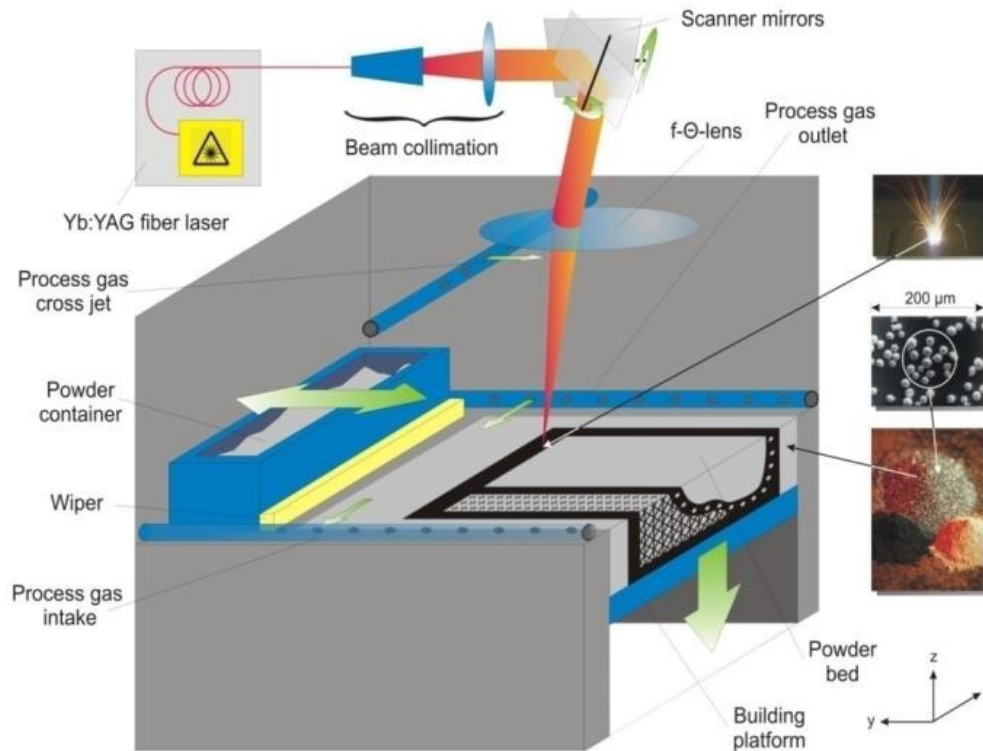
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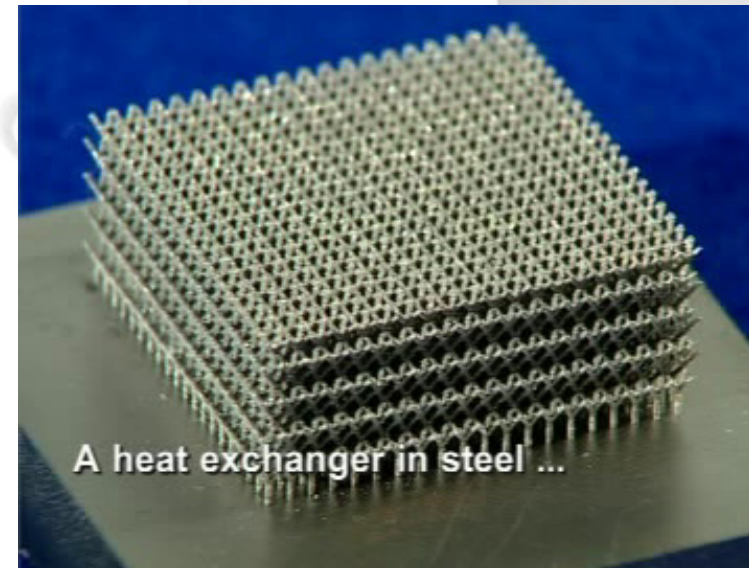
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THE SLM PROCESS

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TECHNOLOGIES GROUP



SLM tech. Vac. casting Alloys



A heat exchanger in steel ...

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PRODUCT PORTFOLIO



Generative Metal Processes



SLM 250 SC



SLM 250 PR



SLM 125
10.2009



SLM 100



SLM 50
10.2009



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Product Portfolio

Universal Metal Powders Supply



MTT SLM Material properties / SLM Werkstoffkennwerte Realizer GmbH
Research & Production Rapid Prototyping

Material	Roughness		Hardness	Tensile Strength Zugfestigkeit	Yield strength Dehngrenze	(notched) Impact Work (Kerbi Schlagarbeit)	Thermal Conductivity Wärmeleitfähigkeit
	R _a , X/Y [µm]	R _a , Z [µm]					
produced, up to 1 µm polished, up to 1 µm polished and 1 µm							
Stainless Steel							
1.4410	16	38	272 HV	780	540	90	16.8
	(+/- 2)	(+/- 4)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 4)	(+/- 0.5)
1.4404 / 316L	16	38	272 HV	825	525	75	14.8
	(+/- 2)	(+/- 4)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 4)	(+/- 0.5)
Titanium							
Ti 6Al 4V	14	36	40 HRC	1020	920		19.4
	(+/- 2)	(+/- 4)	(+/- 20)	(+/- 20)	(+/- 20)		(+/- 0.5)
Ti 6Al 4V ELI	14	36	42 HRC	1150	890		19.4
	(+/- 2)	(+/- 4)	(+/- 20)	(+/- 20)	(+/- 20)		(+/- 0.5)
Ti	14	36	140 HB	380	340	38	20
	(+/- 2)	(+/- 4)	(+/- 10)	(+/- 10)	(+/- 10)	(+/- 2)	(+/- 0.5)
Cobalt Chrome							
CoCr28-4	17	29	35 HRC	910	580		
	(+/- 2)	(+/- 4)	(+/- 10)	(+/- 20)	(+/- 20)		

11.07.2006

MCP-HEX Tooling, SLM Tech Center, Hauptstraße 35, D-33176 Bielefeld
Tel.: +49 (0) 5201 - 30 77 8-0 / Fax: +49 (0) 5201 - 30 77 8-12 / eMail: SLM@mcp-group.de

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MTT SLM Material properties / SLM Werkstoffkennwerte Realizer GmbH
Research & Production Rapid Prototyping

Material	Roughness		Hardness	Tensile Strength Zugfestigkeit	Yield strength Dehngrenze	(notched) Impact Work (Kerbi Schlagarbeit)	Thermal Conductivity Wärmeleitfähigkeit
	R _a , X/Y [µm]	R _a , Z [µm]					
produced, up to 1 µm polished, up to 1 µm polished and 1 µm							
Tool Steel							
1.2344 / H13	13	34	54 HRC	1730			24.1
	(+/- 2)	(+/- 4)	(+/- 20)	(+/- 20)			(+/- 0.5)
M232	14	35	48 HRC	1580		350	25
	(+/- 2)	(+/- 4)	(+/- 20)	(+/- 20)		(+/- 100)	(+/- 0.5)
Aluminum							
Advent 20g	1000	30	1000	1000	1000	30	1000
	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)
Brass							
62S	10	1000	10	1000	10	1000	10
	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)	(+/- 20)

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Page / Seite 2



Open System,
largest Variety of Metal Powders,
also usable for Non-MTT Equipment!!!

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SLM PROCESS CERTIFICATIONS

Quality:

DIN/ISO 9001-2008

Technology:

**TÜV, CE-Mark,
UL-Mark, ATEX**

Dental:

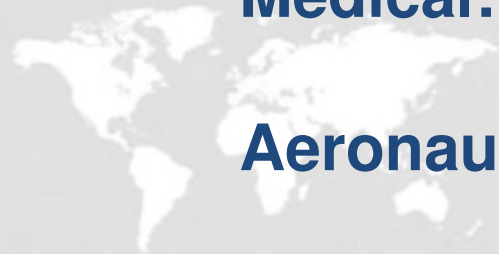
ASTM F 75-1

Medical:

HAZOP, Biocompatibility

Aeronautical:

Pending



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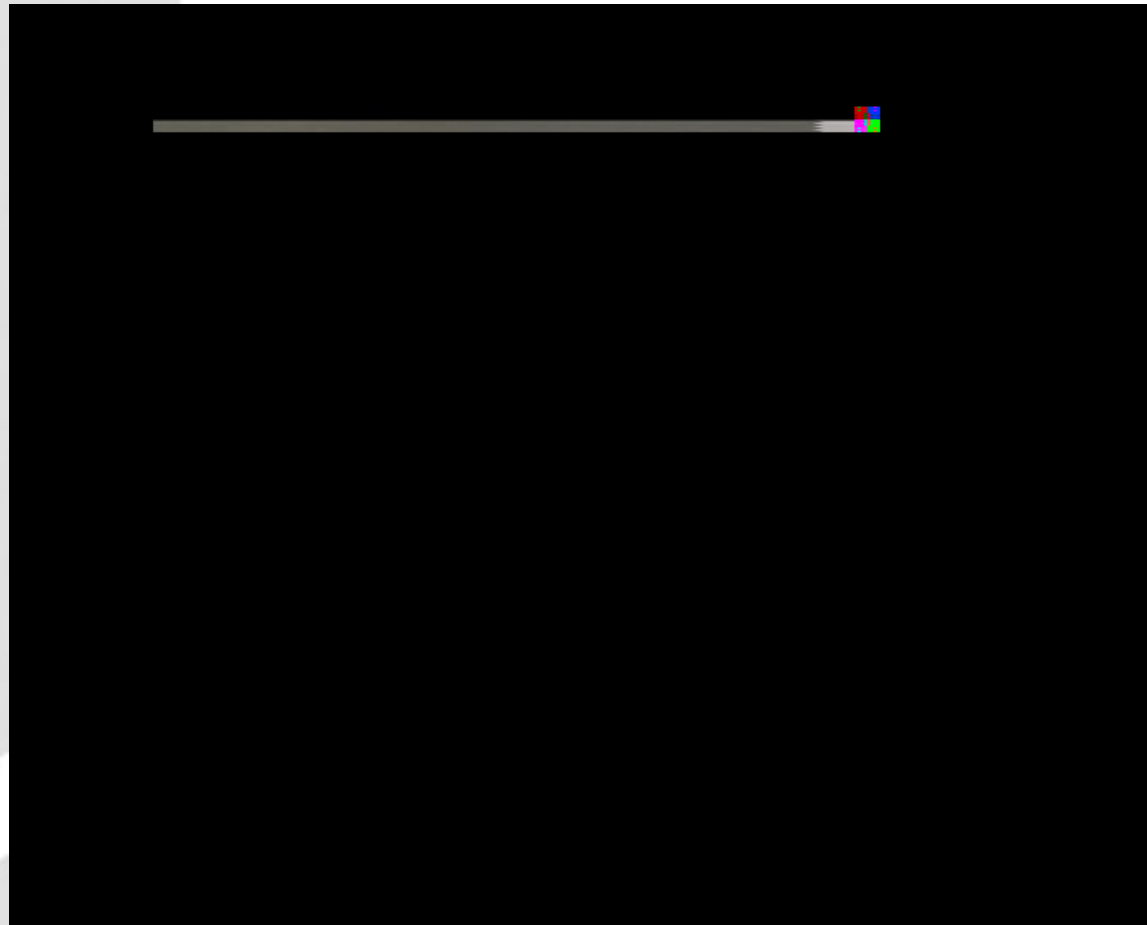


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SLM machine in operation



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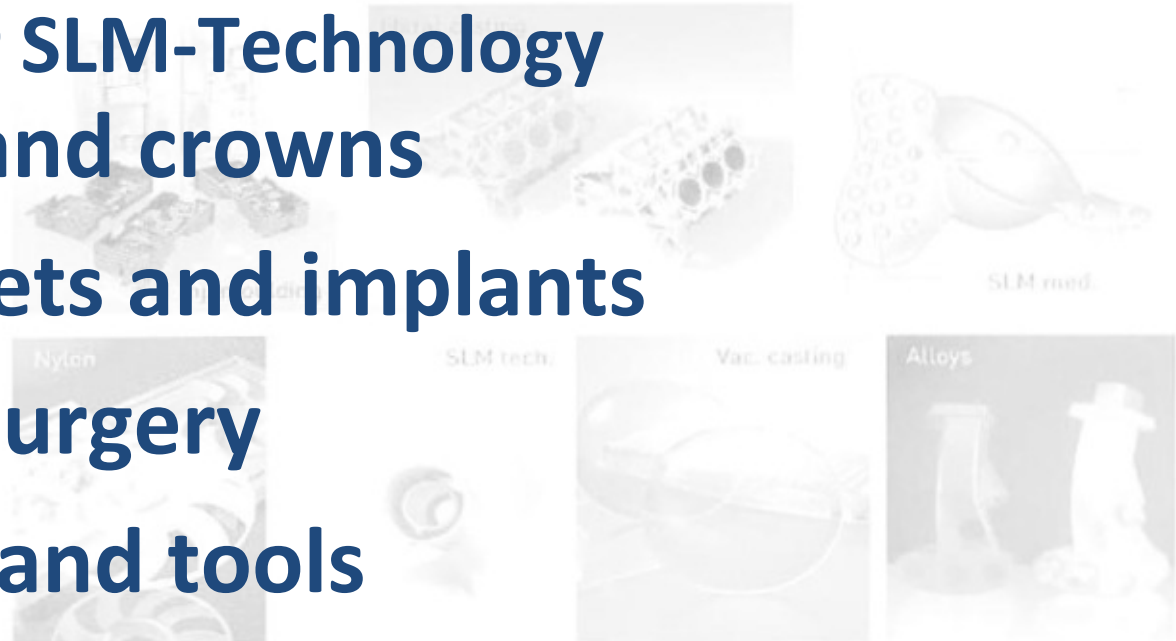
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Different Medical Applications for SLM-Technology

- Dental caps and crowns
- Dental brackets and implants
- Maxiofacial surgery
- Surgical aids and tools
- Bone replacement parts
- Hip and Knee replacements



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SLM CASE STUDY DENTAL

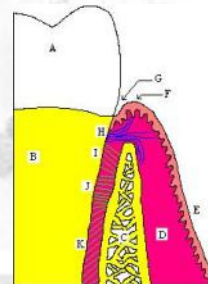


Amalgamic repair of defective tooth



Tooth prep. for crown placement

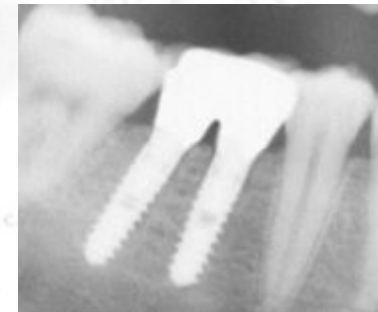
Crown design



Fitted crown



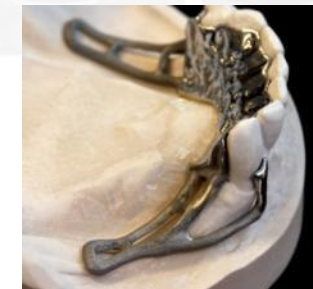
If you don't trust that!



**Screw in solutions
available**



**SLM crown production
for a fragment of
traditional way costs!
Over 400 individual units in one shift**



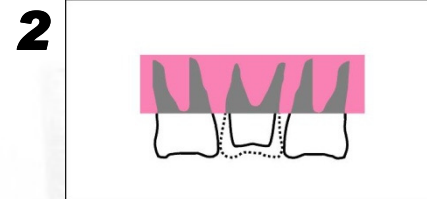
**Individual bridges,
No design limits!**

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Standard Dental Procedures
for producing caps, crowns and bridges



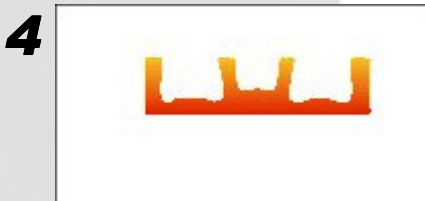
Zahn erhält Krone
Tooth requiring crown



Nach dem Schleifen
After preparation



Silikon - Abdruck
Silicone impression



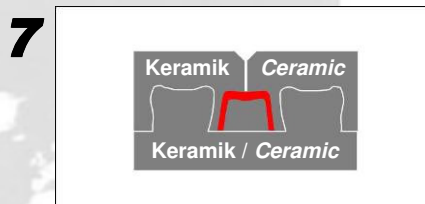
Silikon - Abdruck
Silicone impression



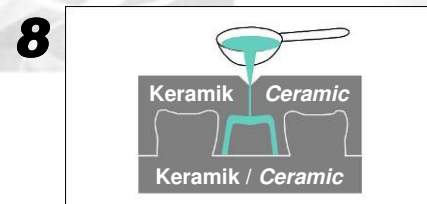
Keramischer Abguss
Ceramic casting



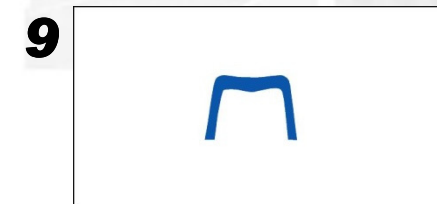
Modellierte Kappe in Wachs
Re-modelled tooth cap in wax



Keramische Einbettung
Ceramic encapsulation



Metallgießen
Metal casting

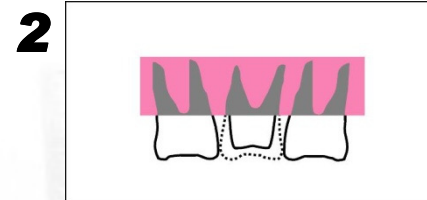


Gegossene und gefinishte Kappe
in Kobalt / Chrom
Cast and finished cap in cobalt / chrome

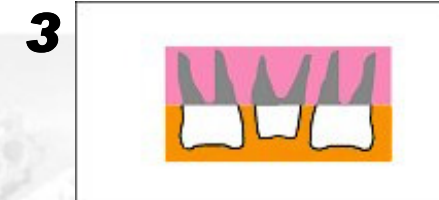
New Dental Manufacturing Procedure with MTT Realizer^{SLM}
Selective Laser Melting, for producing caps, crowns and bridges



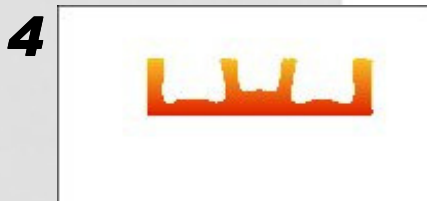
Zahn erhält Krone
Tooth requiring crown



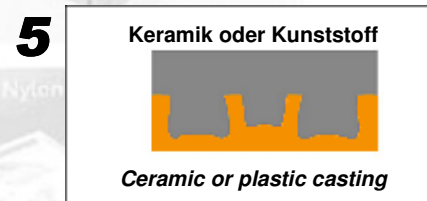
Nach dem Schleifen
After preparation



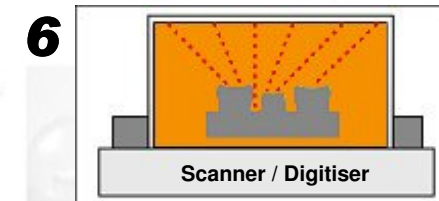
Silikon - Abdruck
Silicone impression



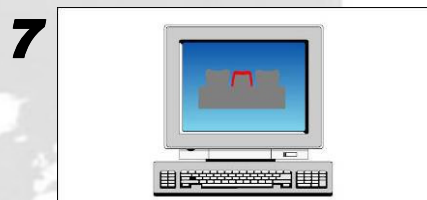
Silikon - Abdruck
Silicone impression



Keramischer oder Kunststoff-Abguss
Ceramic or plastic casting



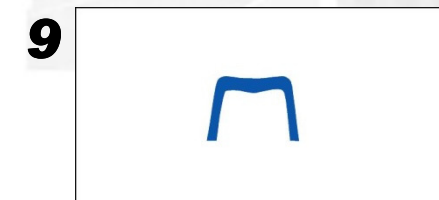
Scannen des Abgusses für Punktwolke
Scanning of casting for point clouds



Die Kappe wird virtuell modelliert
The cap is modelled virtually



Über 100 **individuelle** Teile
auf 100 x 100 mm in 6 Stunden
*Over 100 individual parts
per 100 x 100 mm in 6 hours.*



Durch SLM generierte Kappe in
Kobalt / Chrom oder anderen Materialien
*Finished cap, generated in cobalt / chrome
or other materials with SLM*

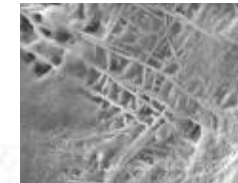
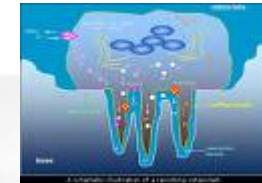
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SLM CASE STUDY DENTAL / MAXIOFACIAL



Traditional metal repair



Hydroxyapatite structure



Titanium parts for jaw bone replacement studies

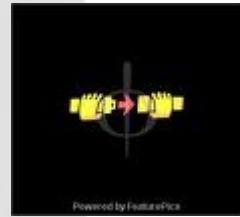


**Open structures for
Hydroxyapatite
filling test**

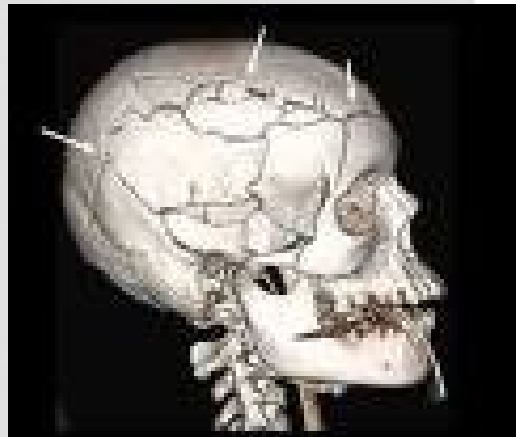
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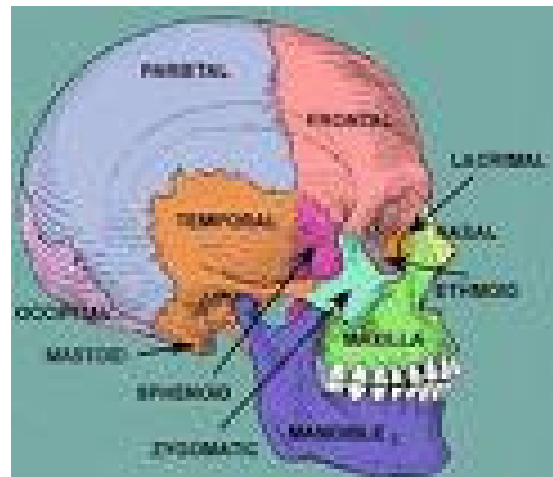
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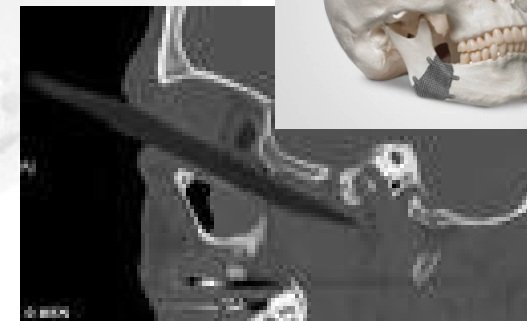
Maxiofacial surgery



Fractured skull (accidental)



Bone structure of skull



Metal pin fractured Jaw bone



Traditional H-Apatite filling



Titanium plate implant by SLM



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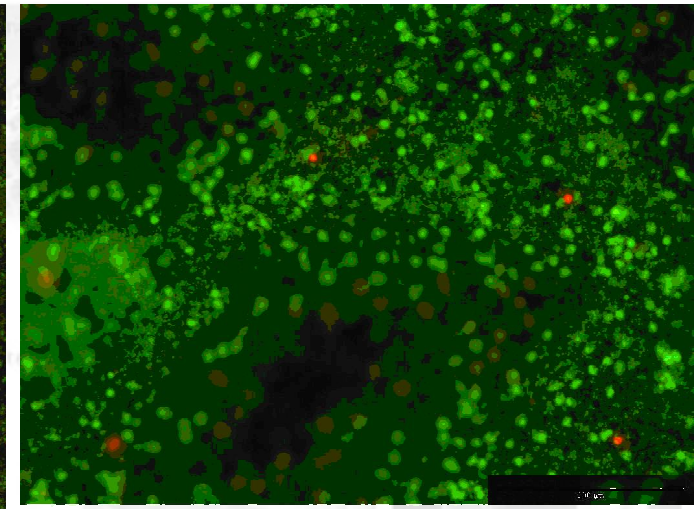
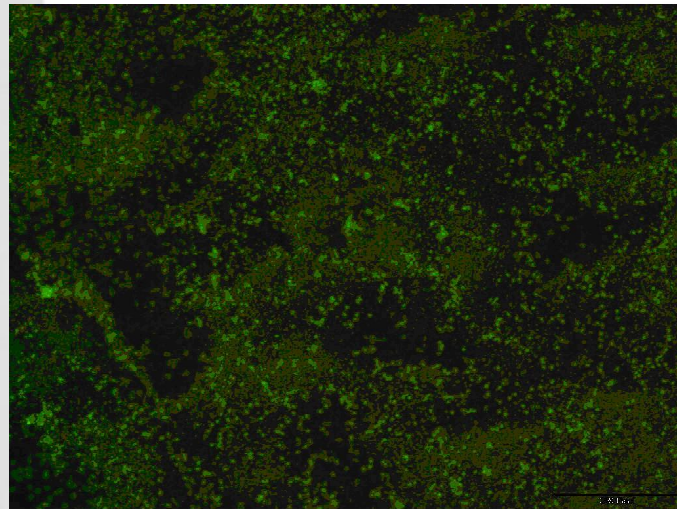
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SLM[®] Biocompatibility Tests

**Lymphocytes
on Ti6Al7Nb**



Fluorescence microscope photos of a sample in two different magnifications. The shown cells are human lymphocytes. Green colour identifies living cells and red ones show dead ones. As a result a very good biocompatibility can be seen.



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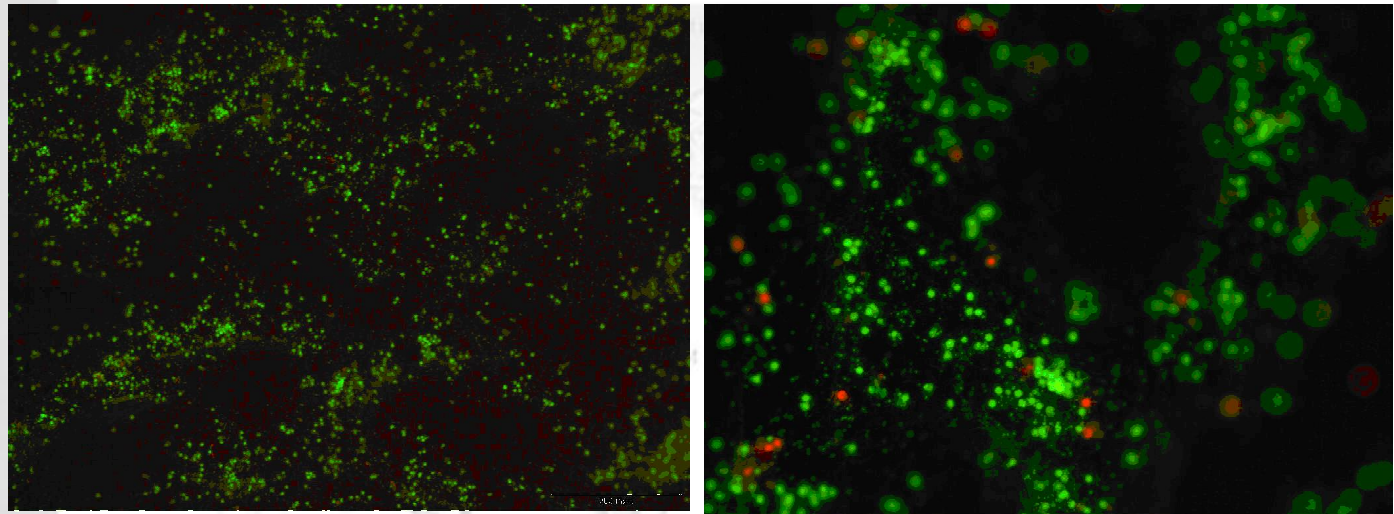
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SLM[®] Biocompatibility Tests

Granulozytes
on Ti6Al7Nb



Fluorescence microscope photos of human granulozytes used for cell adherence tests. Like before a very good biocompatibility can be seen.



The tests were done at *Berufsgenossenschaftliche Kliniken Bergmannsheil Bochum, Universitätsklinik, Bürkle-de-la-Camp-Platz 1, 44789 Bochum*

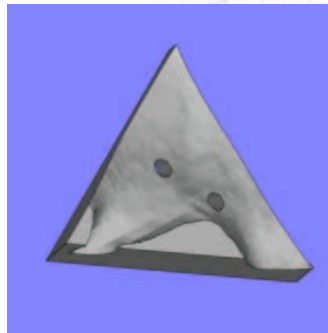
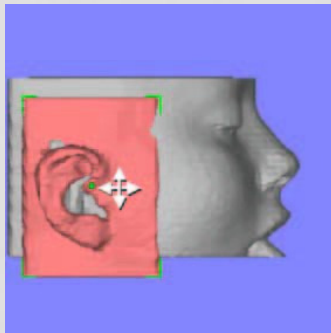
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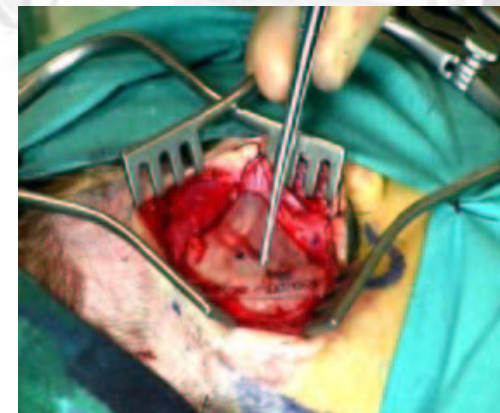
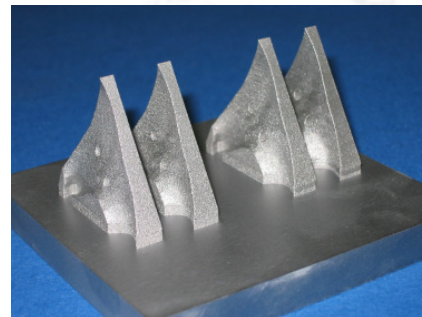
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SLM CASE STUDY MEDICAL



Drilling guide
For
permanent
Hearing aid
implant
Courtesy of
PDR-Cardiff

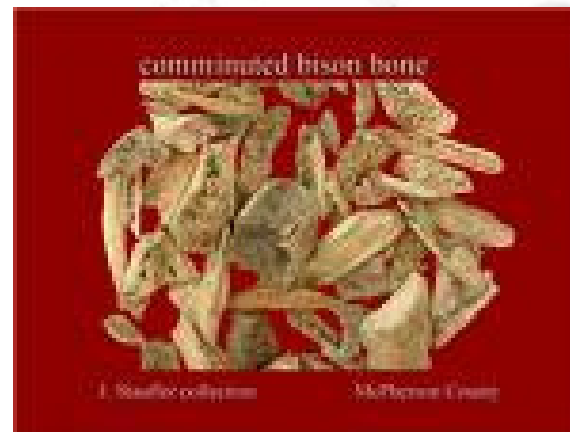
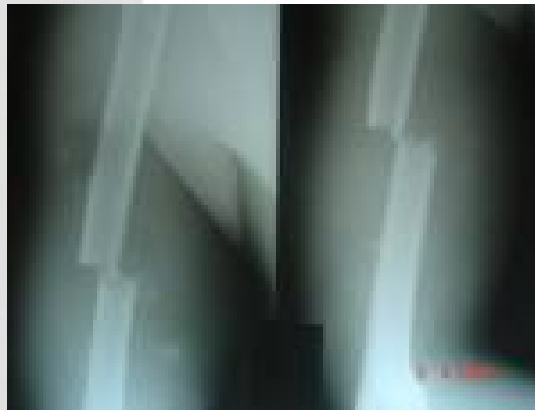


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Severe fracture of bones



HELP!



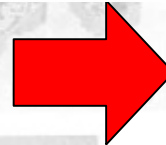
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SLM[®] Applications

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Rapid Manufacturing of Bone Replacement Structures

Trabecular implant structure (top) derived from CT and built in Ti (bottom), Co-Cr-Mo, 316 L, or other biocompatible materials



Implant coated with Hydroxy Apatite (HA) immediately prior to implantation



SLM med.

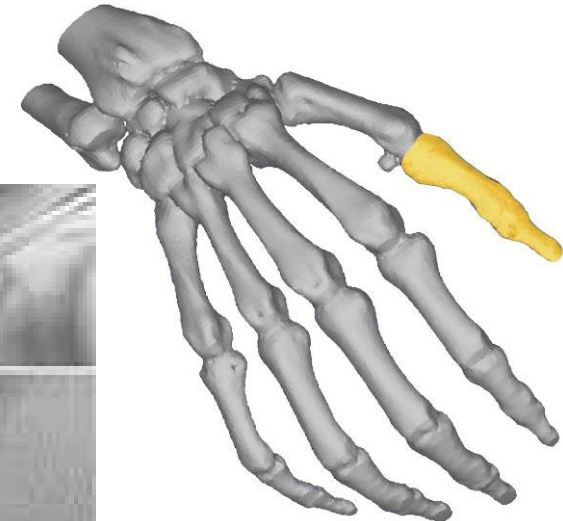
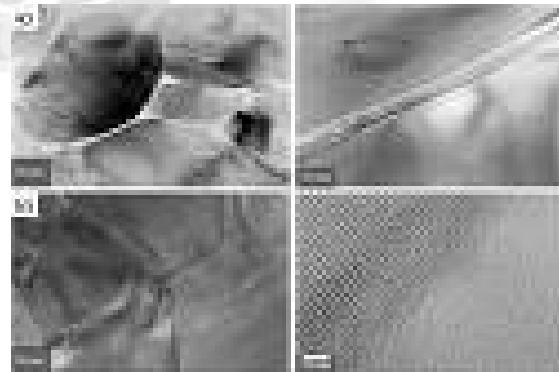
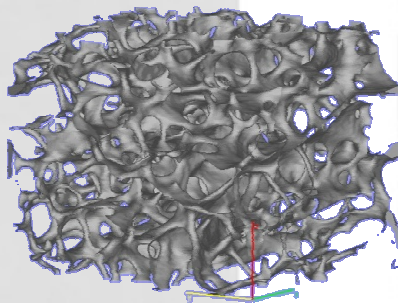
Alloys



Figure 1. Trabecular implant structure derived from CT data.



Figure 2. Trabecular implant structure derived from CT data.



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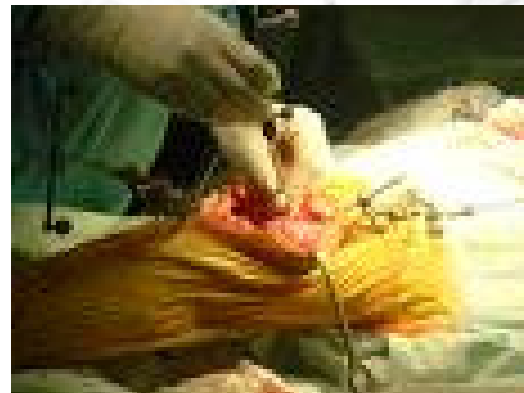
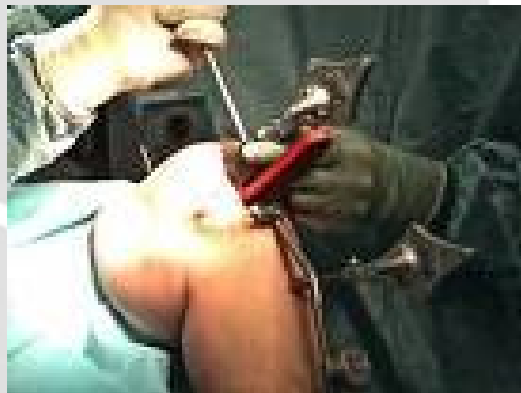
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#ADAM

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Knee replacement



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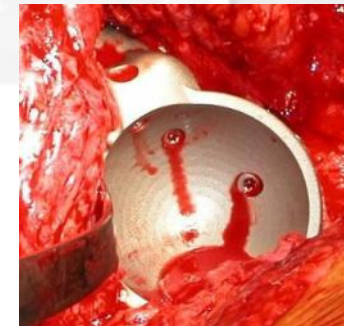
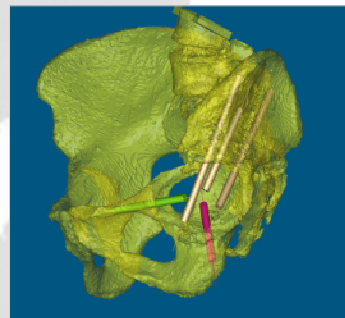
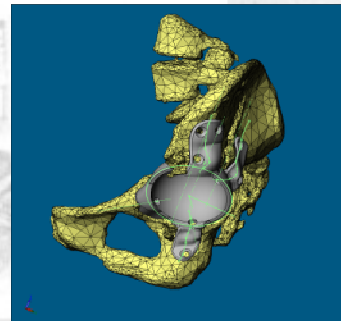
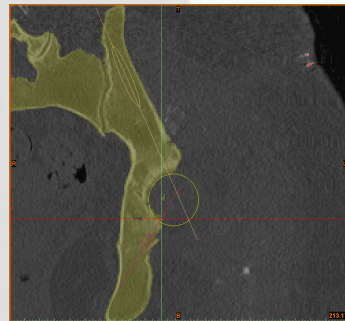
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SLM CASE STUDY MEDICAL

**Acceptabular
cup
For Hip repair
Courtesy of
Royal Perth
hospital**



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Before....

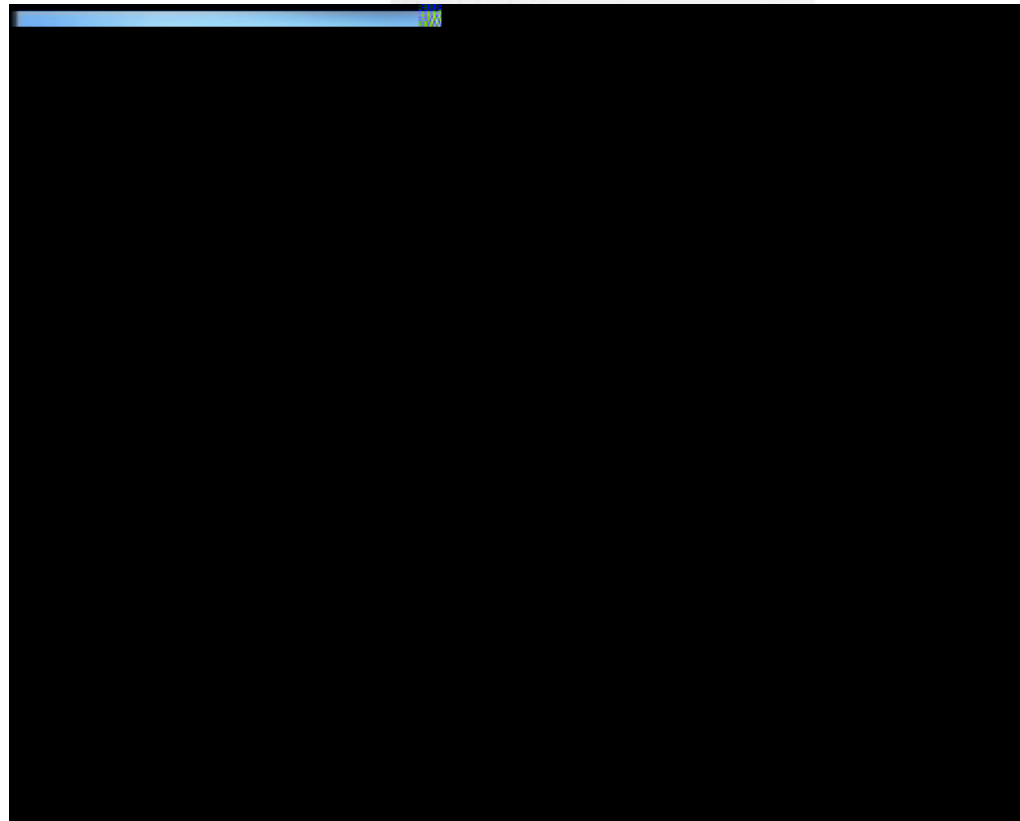


Normal hip



Our main goal and aim are
Happy customers!

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and after!

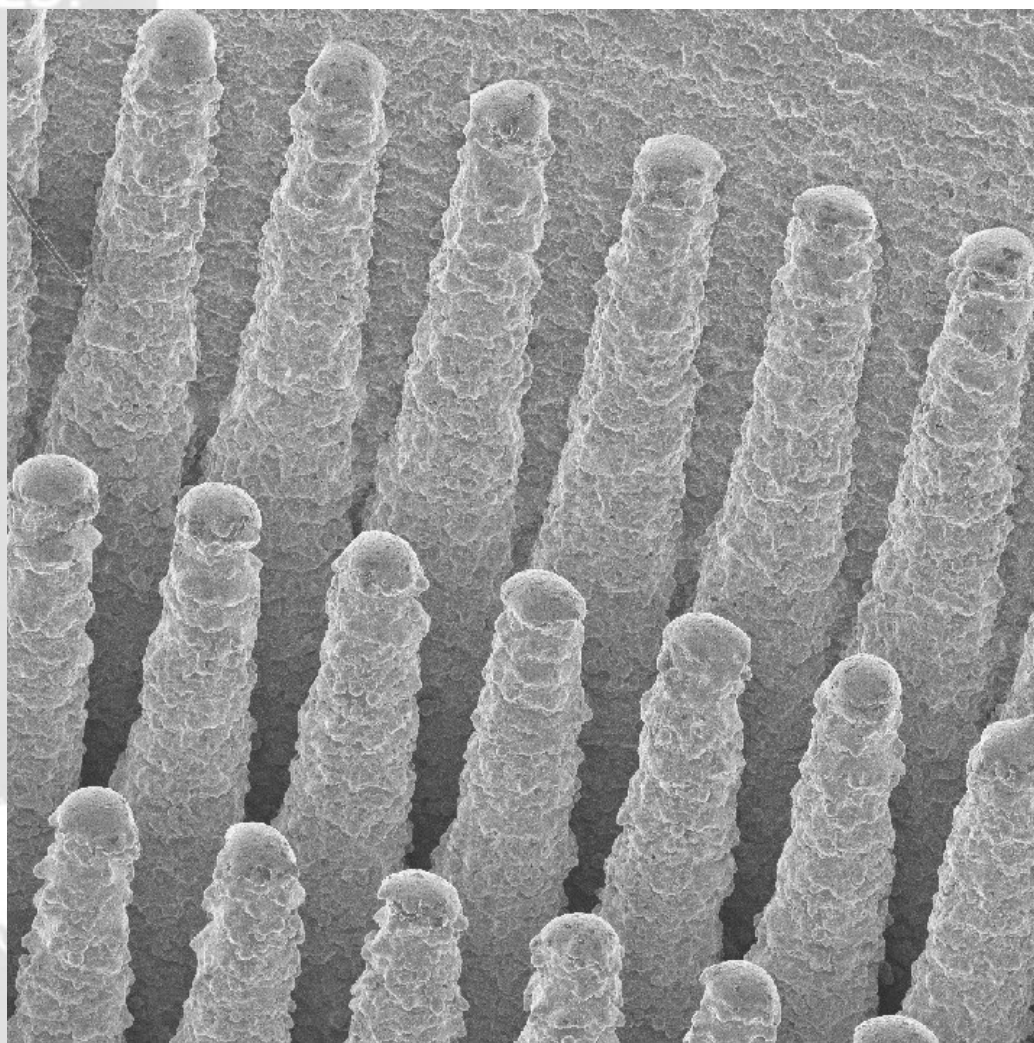
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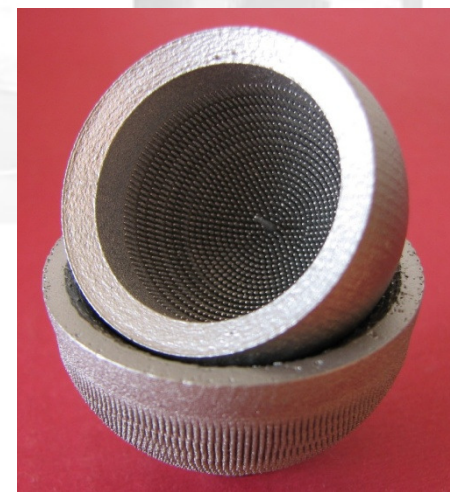
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What do we learn
from
this presentation?!



Do Sports but moderately!



Drive home slow and safely!



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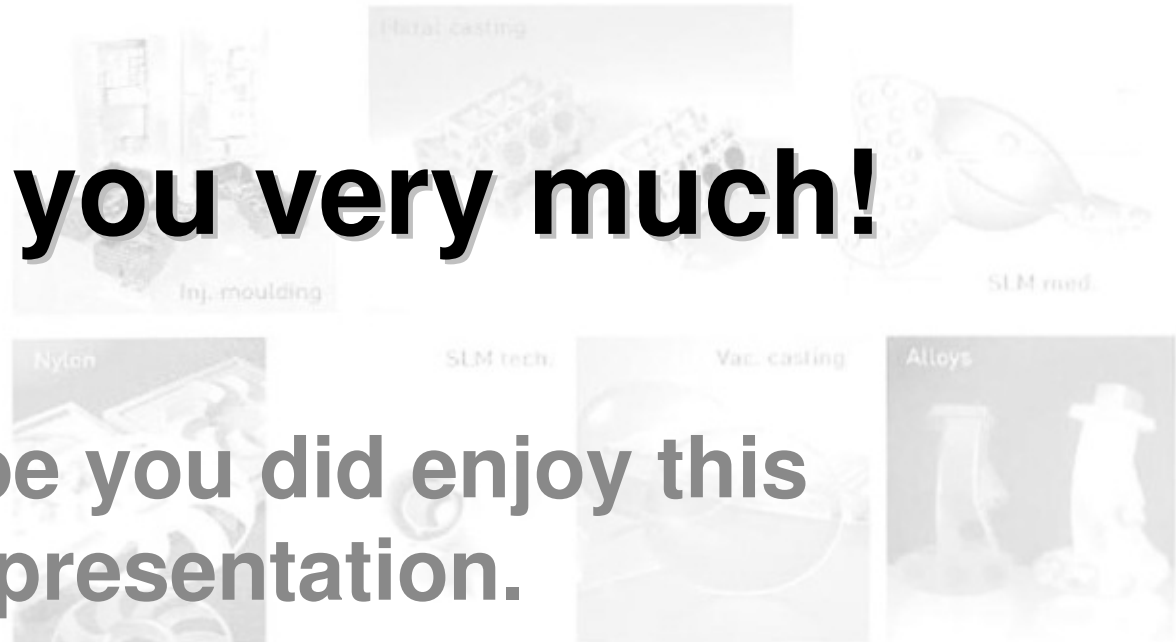


Thank you very much!

We hope you did enjoy this
presentation.



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