

中国3D打印应用市场白皮书

White Paper of China 3D Printing Application Market

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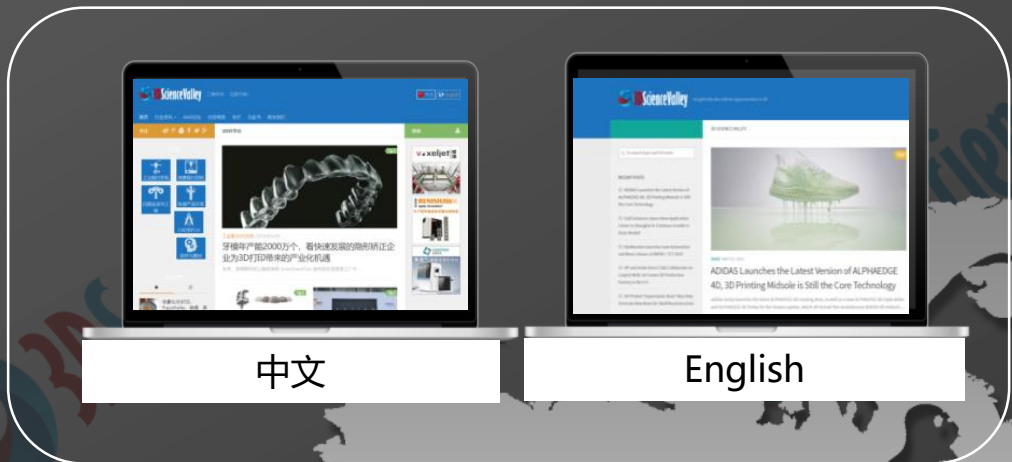
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3D Science Valley
市场研究白皮书系列、Insights行业洞见、AME卓越论坛、《3D打印与工业制造》，四大板块之间相互联动，3D科学谷立足上海与德国柏林，全球视野，精准洞察，(www.3dsciencevalley.com)，是国际上最有影响力的3D打印界的智囊平台。



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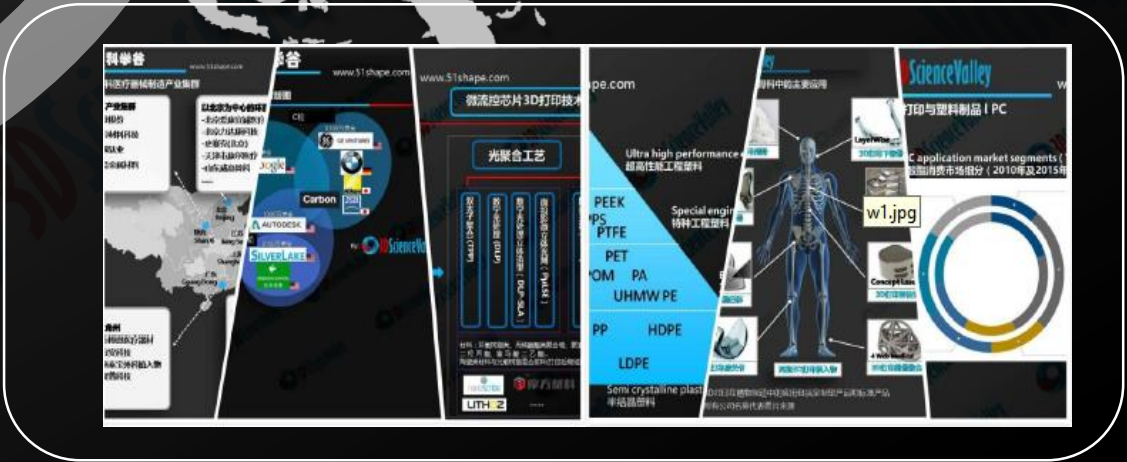


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AME卓越论坛聚焦3D打印改变产品的方式

行业应用白皮书提升行业对3D打印的认知水平



全球

交汇

升级

多维

融合



Statistics 数据

1 中国3D打印市场概况

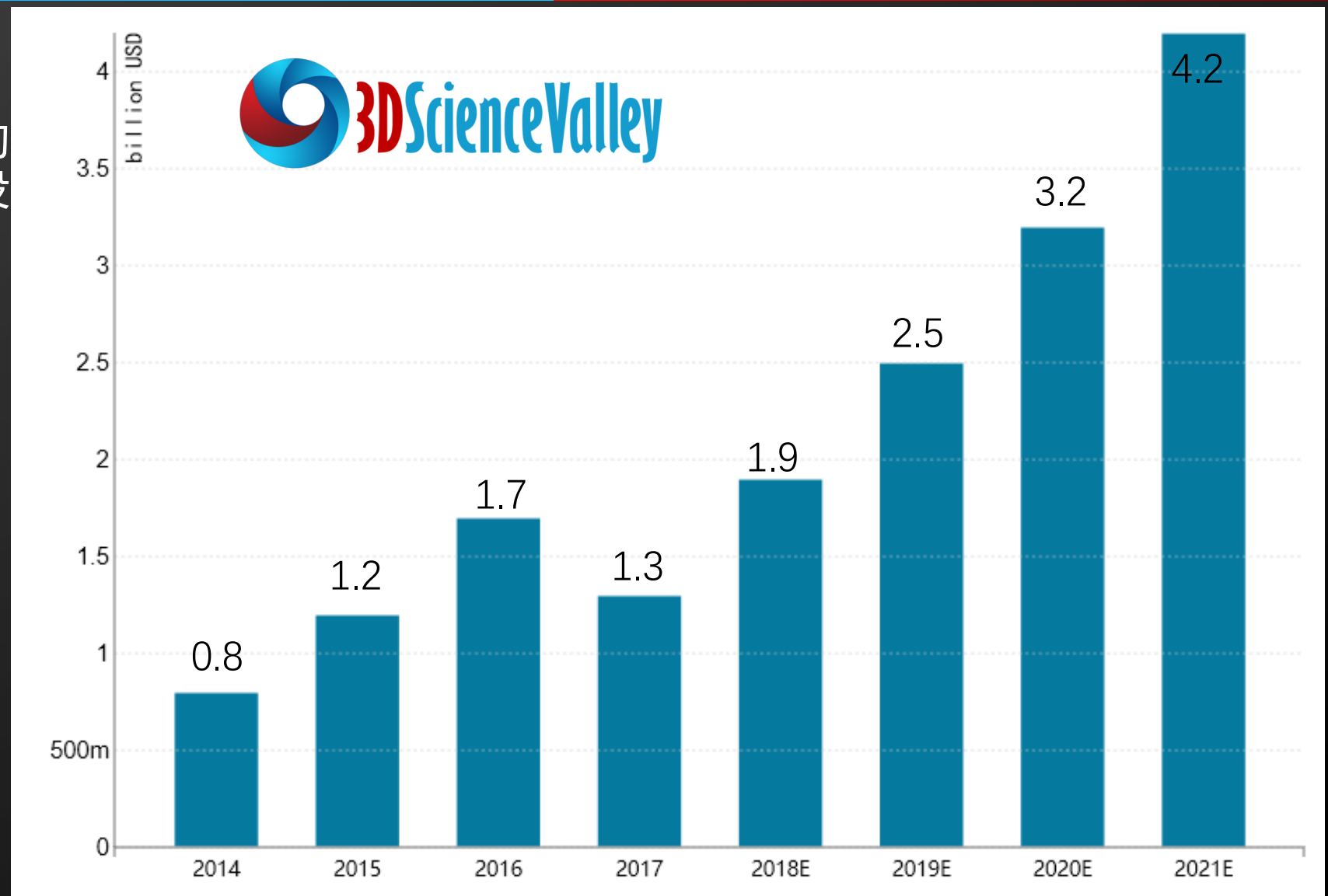
Overall 3D Printing Market in China

中国3D打印市场情况及预测

China 3D Printing Industry Market and Forecast (billion USD)

根据3D科学谷的市场研究，2017年3D打印市场共计约82亿人民币，同比出现下跌状况，主要是因为当前中国的3D打印市场的销售情况过于依赖设备销售，而很多卖出去的设备并没有得到很好的利用。设备的销售并不是一个持续增量的市场，当前科研目的的设备采购达到一定的阶段性饱和度的时候，3D打印市场在中国出现回调成为不以意志为转移的必然，但这并不会影响3D打印长期向上的趋势。

It seems especially difficult for 3D printing companies in China to reach out to the local manufacturing industry. In China today, relatively few companies are aware of the power of 3D printing and the Chinese market lacks the openness and the understanding for the role this technology can play. This is because till recently, China focused on low value added manufacturing, while this is not the strength of 3D printing. Though this is clearly changing, this heritage created a gap which is very noticeable today and probably reason for the high export shares in revenue for many Chinese 3D printing companies.



Exchange rate:6.3

Billion USD / Resource:3D Science Valley

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3D打印服务

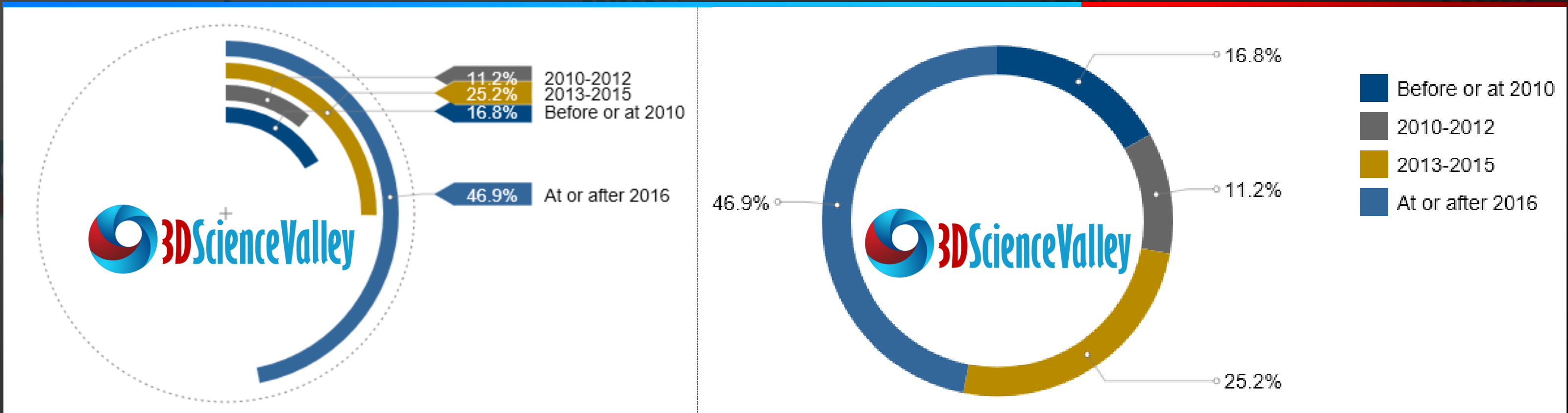
3D Printing Service

2016年及之后，越来越多的公司进入到3D打印服务市场

More companies started to provide 3d printing service in the year of 2016 and after

进入到3D打印服务市场的公司/中国

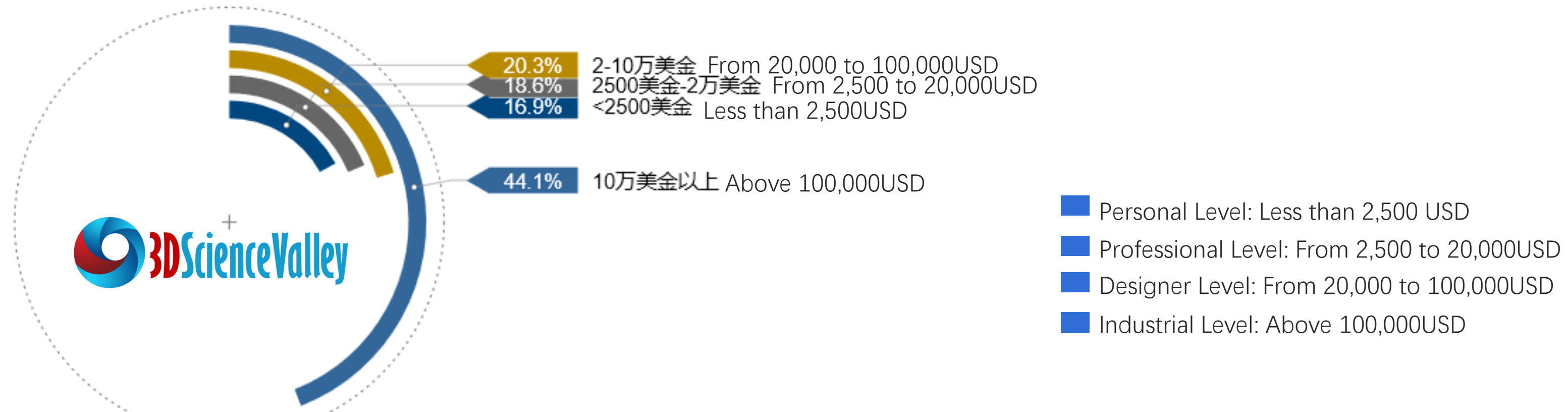
3D Printing Companies Enter to the Market / China



3 3D打印设备 3D Printing Systems

根据3D科学谷的市场调研，中国市场对于高端的工业级3D打印设备的采购占主流。44.1%的被调查企业采用的是10万美金（单台）以上的3D打印设备。
According to the 3D Science Valley market research, the high-end industrial-grade 3D printing equipment prevails in China. 44.1% of the companies are using 3D printing systems with unit price above 100,000 US dollars.

3D打印设备价格区间/中国 3D Printing Systems Price Range/ China

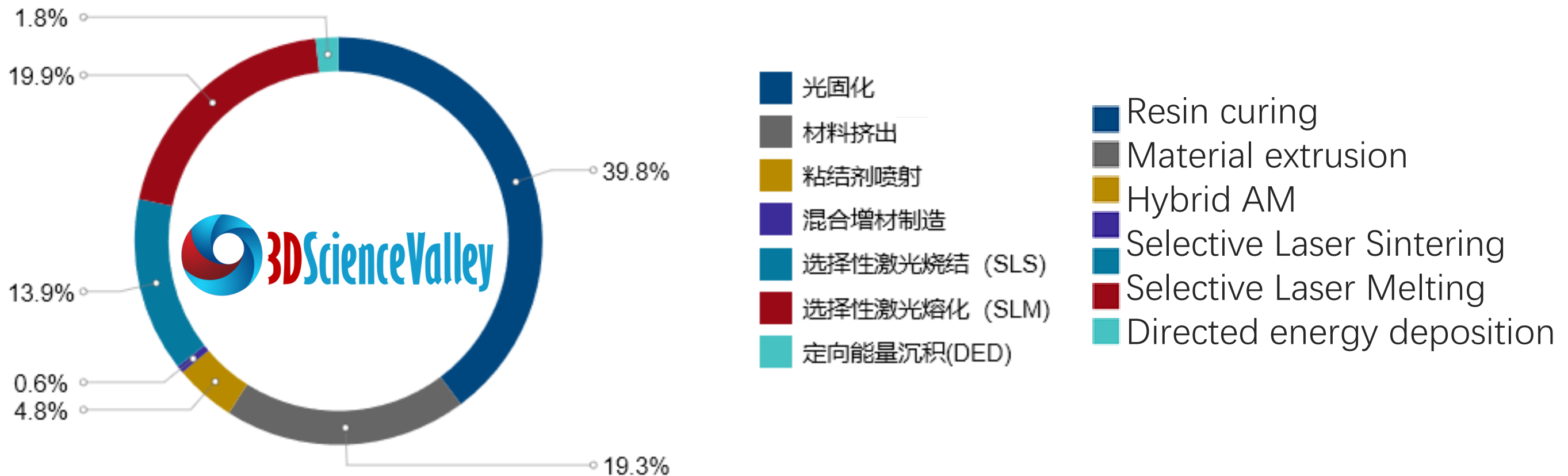


4 3D打印设备类型 3D Printing Systems Types

根据3D科学谷的市场调研, 当前中国市场对于光固化的设备拥有占主流, 39.8%的被调查企业拥有光固化设备, 其次是选择性激光熔融以及材料挤出设备.

According to the 3D Science Valley market research, Currently resin curing systems dominated China 3D printing market and occupied 39.8% of the market, followed by selective laser melting and material extrusion systems.

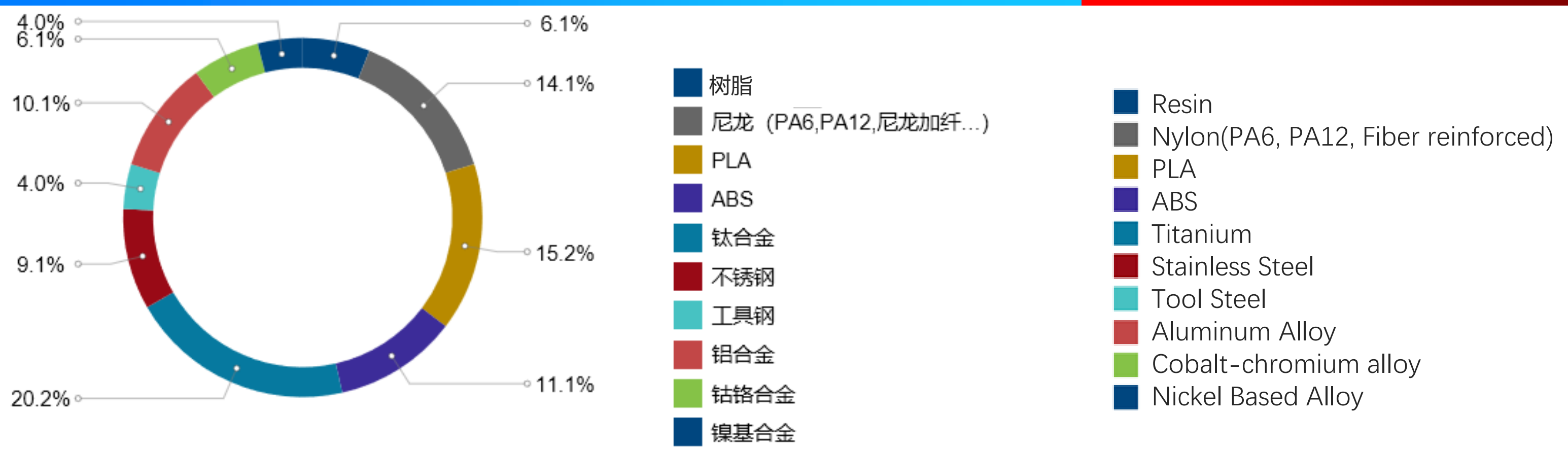
3D打印设备类型/中国 3D Printing Systems Types/ China



5 3D打印材料类别 3D Material Types

根据3D科学谷的市场调研，当前中国市场对于光敏树脂、尼龙、PLA、钛合金、不锈钢的需求占3D打印材料的主导地位。
According to the 3D Science Valley market research, Currently China market demand of 3D printing materials are resin, nylon, PLA, ABS, titanium, stainless steel, tool steel, aluminum alloy, cobalt-chromium alloy, nickel based alloy and else.

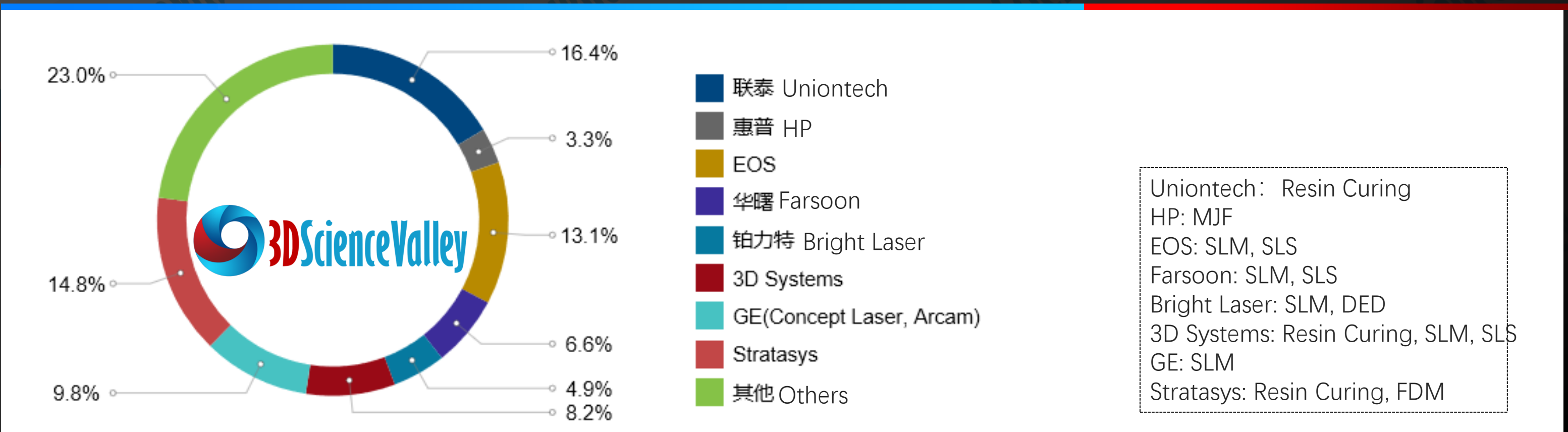
3D打印材料类别/中国 (按金额)
3D Printing Materials/ China



6 3D打印设备品牌 3D Printing Systems Brand

根据3D科学谷的市场调研，当前中国市场的主流设备品牌包括联泰、EOS、华曙、铂力特、3D Systems、GE、Stratasys、惠普等
According to the 3D Science Valley market research, Currently the industrial level 3D printer brands are mainly including UnionTech, EOS, Farsoon, Bright Laser, 3D Systems, GE, Stratasys, HP and else.

所拥有的3D打印设备品牌的企业数量/中国 (按企业数量)
3D Printers Brands/ China (By Companies Quantity)



7

3D打印发展瓶颈

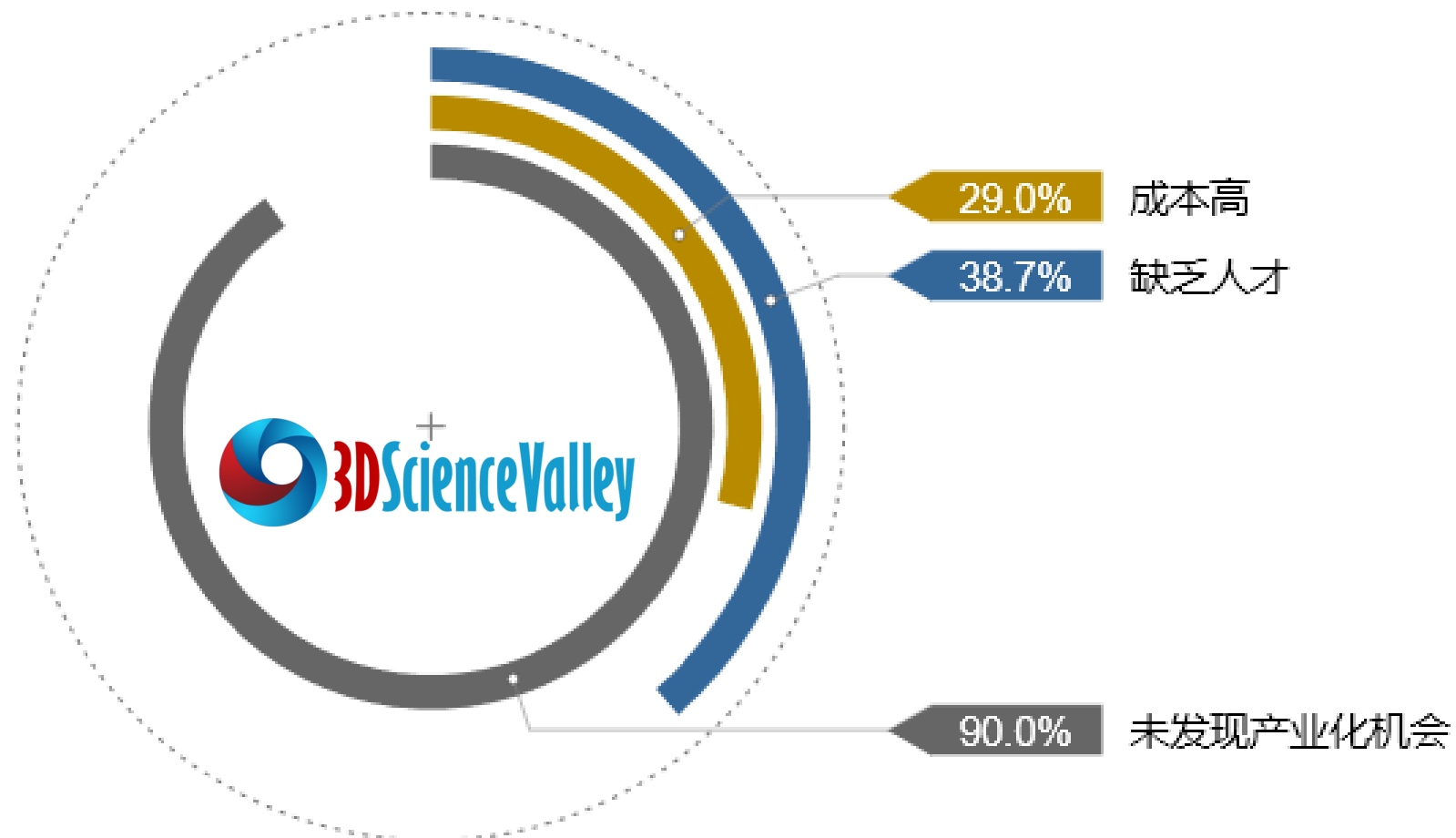
3D Printing Development Bottleneck

根据3D科学谷的市场调研，当前中国市场3D打印的发展瓶颈主要包括：未发现产业化机会（90%的受访企业认为），缺乏人才，以及3D打印成本过高。

According to the 3D Science Valley market research, Currently the bottleneck set 3d printing development in behind is about not aware of industrialization opportunities, lacking human resources, and the high cost of 3d printing.

3D打印材料类别/中国

3D Printing Materials/ China



8 3D打印应用 | 中国市场先行者

3D Printing Application | China Market Frontiers

Frontiers who enter to the 3D printing application market
最早进入到3D打印应用市场的典型公司



陕西恒通智能机器有限公司
Shanxi HengTong
china-rpm.com



东莞市科恒手板模型有限公司
Dongguan Keheng
www.kehengdg.com



无锡易维模型设计制造有限公司
Wuxi Easyway
www.easyway-model.com



西安铂力特增材技术股份有限公司
Xi'an Bright Laser
www.xa-bl.com



上海悦瑞三维科技股份有限公司
Ureal
www.ureal.cn



三的部落 (上海) 科技股份有限公司
3DPro
www.3dpro.com.cn



上海正雅齿科科技股份有限公司
SmarTee
www.smartee.cn



优联三维打印科技发展 (上海) 有限公司
Alliance3D
www.alliance3d.cn

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Market Segmentation 应用市场细分



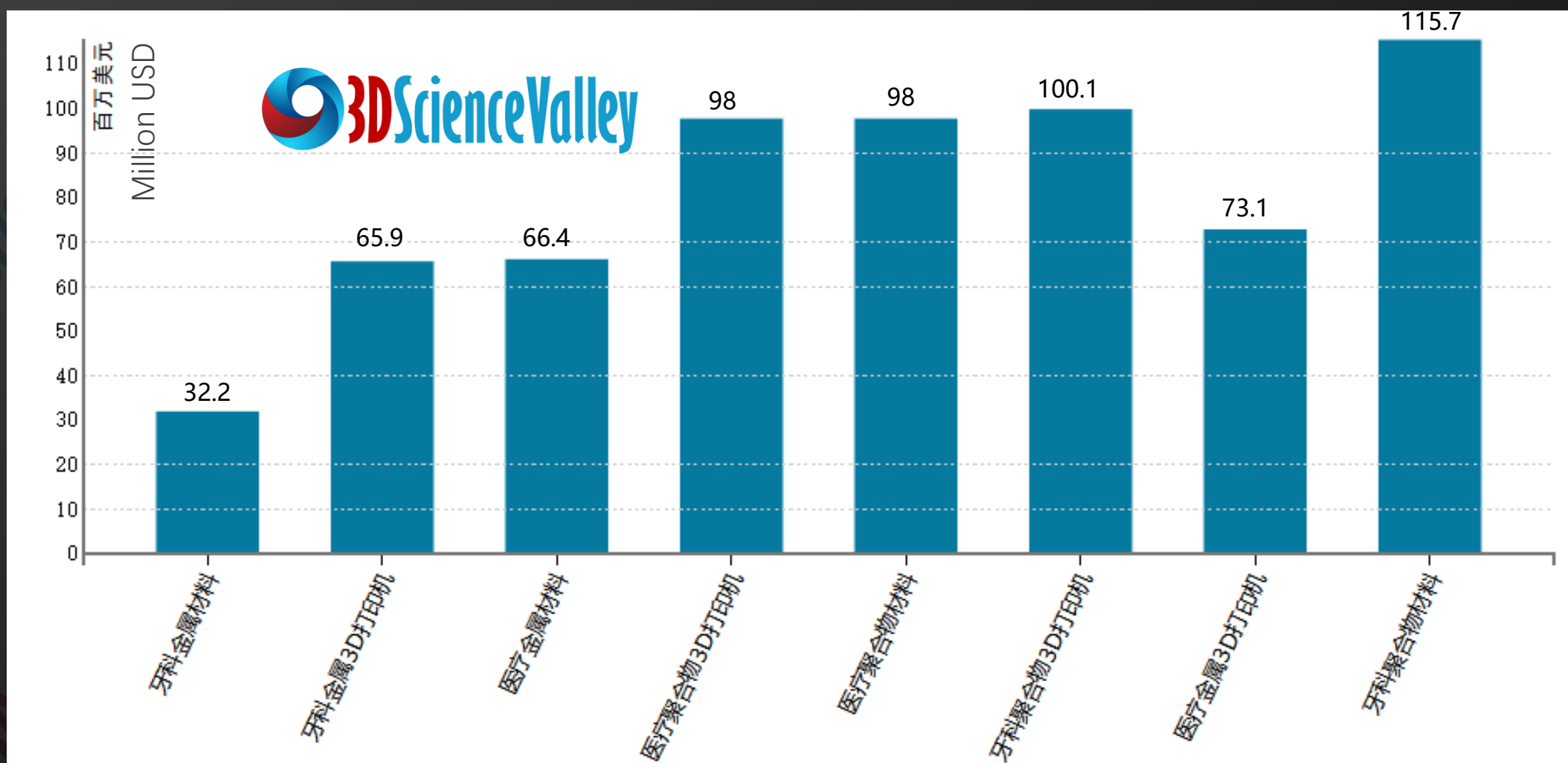
Dental 牙科

9 3D打印牙科市场 3D Printing Dental Market

SmarTech 预计，2017年全球牙科3D打印材料的销售金额达1.479亿美元，其中金属材料为3220万美元，聚合物材料为1.157亿美元；全球牙科3D打印设备的销售金额达1.66亿美元，其中金属设备为6590万美元，聚合物设备为1.001亿美元。

SmarTech expects sales of global dental 3D printing materials to reach \$ 147.9 million in 2017, of which \$ 32.2 million for metallic materials and \$ 115.7 million for polymeric materials; and global sales of dental 3D printing equipment amounting to \$ 166 million, of which metal equipment 65.9 million US dollars, polymer equipment, 1.001 billion US dollars.

2017年全球医疗、牙科领域3D打印收入估算
3D Printing Medical and Dental Market Estimated / Global



数据来源: SmarTech, 单位: 百万美元

10 3D打印与牙科
3D Printing Dental Application



矫正器
Aligner

- 透明矫正器牙模
Transparent aligner
- 舌侧矫正器
Orthodontics



种植牙
Implanted teeth

- 牙冠
Crown
- 牙根、基台
Root, abutment
- 手术导板...
Surgery guide



Image Courtesy:
Xi'an Bright Laser



可摘义齿
Removable denture

- 金属支架
Metal bracket
- 冠桥
Crown bridge
- 铸造模型
Casting model



其他应用 Other application

- 牙科模型、个性化托盘、临时牙冠...
- Dental models,
Personalized trays,
Temporary crowns ...

11 牙科 | 矫正器
Dental aligner

中国牙科矫正器领域活跃企业 (与3D打印相关)
Companies active in 3d printing / dental aligner industry

Highly Specialized Companies

- 上海时代天使医疗器械有限公司 Angelalign
- 上海正雅齿科科技有限公司 Smartee Shanghai
- 西安市恒惠科技有限公司 Xian Huiheng
- 美加医学推广有限公司 Mega



Others

- 深圳爱尔创口腔技术有限公司
- 深圳市倍康美医疗电子商务有限公司
- 苏州迪凯尔医疗科技有限公司
- 西安博恩生物科技有限公司
- 西安增材制造国家研究院有限公司
- 伊科利尔国际有限公司
- 浙江隐齿丽医学技术有限公司
- 中国科学院沈阳自动化研究所
- 金华市众邦前景医疗器械科技有限公司

12 牙科矫正器领域典型企业
Typical Company in 3d printing dental aligner



时代天使是一家专业从事口腔隐形正畸技术研发、隐形矫正器生产及销售的企业。应对牙科数字化发展趋势，时代天使还推出了在线隐形矫正器3D打印平台。

Angelalign is professionally engaged in Oral orthodontics technology research and development, To facilitate the communication with patients for invisible dental aligner business, Angelalign has also introduced an online 3D printing platform. The online platform will also further enhance the leadership of Angelalign in 3d printing dental aligner business segment.

Smartee无托槽隐形矫治技术是正雅公司在专业正畸理论的基础上，融合应用了3D打印技术、计算机三维辅助设计技术、数字化快速成型技术，并经过大量科研、临床实践而开发出的一种具有完全自主知识产权的正畸系统。

Smartee® invisible treatment technology combines 3D printing technology, 3D computer-aided design technology (CAD), and digital 3D modeling (CAM) technology together. After wide-ranged and long term researches and clinical practices, Smartee® developed an unique orthodontical system and possessed a complete independent intellectual property rights.

13 牙科 | 义齿
Denture

中国义齿领域活跃企业 (与3D打印相关)
Companies active in 3d printing / denture industry

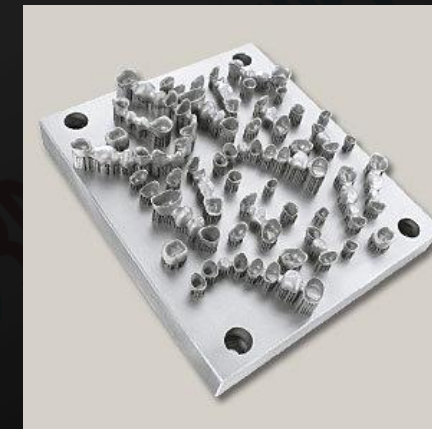
Specialized Companies

- | | |
|-------------------|--|
| 惠州鲲鹏义齿 | Huizhou Kunpeng |
| 东莞市爱嘉义齿有限公司 | Dongguan Aijia |
| 广州锦冠桥实业有限公司 | Guangzhou Jinguangqiao |
| 广州中国科学院先进技术研究所 | Guangzhou Institute of Advanced Technology Chinese Academy of Sciences |
| 杭州培瑞科技有限公司 | Hangzhou Peirui |
| 河源市精鹰义齿技术有限公司 | Heyuan Jingying |
| 贺利氏古萨有限公司 | Kulzer |
| 南通金源智能技术有限公司 | Nantong Jianyuan |
| 山东迈尔口腔材料有限公司 | Shandong Maier |
| 上海联泰科技股份有限公司-德立齿科 | Uniontech |
| 深圳晗竣雅科技有限公司 | Shenzhen HanJunYa |
| 深圳市倍康美医疗电子商务有限公司 | Shenzhen BeiKangMei |
| 深圳市家鸿口腔医疗股份有限公司 | Shenzhen JiaHong |
| 珠海新茂义齿科技有限公司 | Zhuhai XinMao |
| 深圳奇遇科技有限公司 | Shenzhen QiYu |



Others

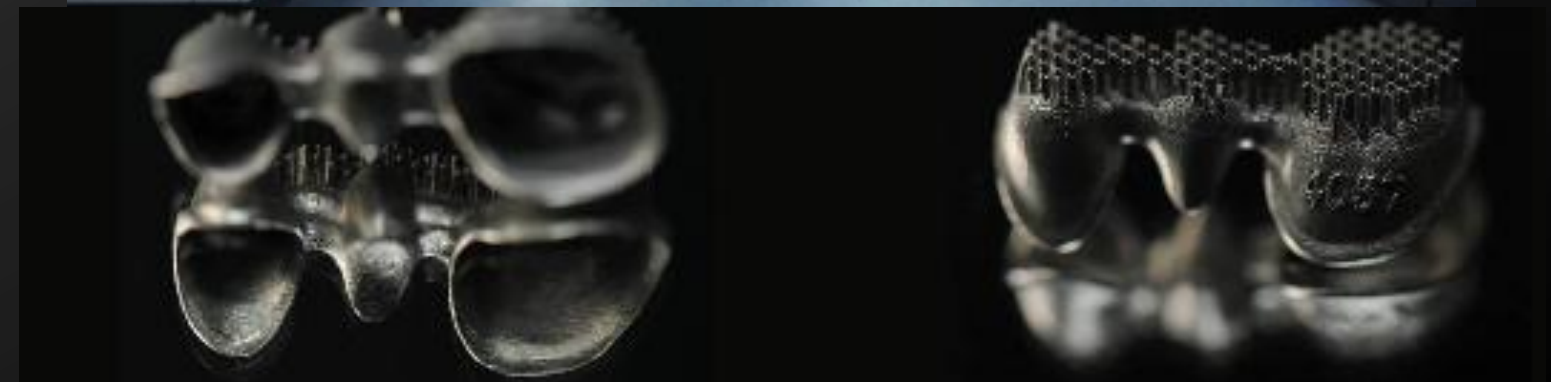
- 东北大学
- 广东工业大学
- 西安工业大学
- 中国人民解放军第四军医大学
- 河北工业大学
- 南京医科大学附属口腔医院
- 杭州口腔医院有限公司



14 义齿领域典型企业 Typical Company in 3d printing denture

登特公司1994年创立于海南，1999年因承接华西医大的义齿制作回到成都。经过整整20年的发展里程，登特义齿已经成为当今业界公认的知名品牌，是目前国内乃至全世界走在CAD/CAM数字化、机械化、自动化最前沿的高端义齿制作商。作为德国著名牙科品牌BEGO、VITA、WIELAND、DENTAURUM的定点授权技术合作伙伴。

Dengte was founded in 1994 in Hainan, and relocated to Chendu in 1999. After a full 20 years of development, Denture Denture has become recognized as a well-known brand in the industry today. It is currently one of the leading manufacturer of high-end dentures in the forefront of digitalization, mechanization and automation in CAD / CAM in China and around the world. Dengte is designated authorized technical partners of BEGO, VITA, WIELAND and DENTAURUM.



**15 牙科 I 种植
Implant**

**中国种植领域活跃企业 (与3D打印相关)
Companies active in 3d printing / Dental Implant industry**

Specialized Companies

- | | |
|--|--|
| 广州市健齿生物科技有限公司
-Guangzhou Jianchi | 宁波创导三维医疗科技有限公司
-Ningbo Chuangdao |
| 成都华美牙科连锁管理股份有限公司
-Chengdu Huamei | 诺贝尔生物服务公司
-Nobel |
| 大连三生科技发展有限公司
-Dalian Triup | 上海瑞博医疗科技有限公司
-Shanghai Reborn |
| 佛山市安齿生物科技有限公司
-Fushan Anchi | 上海上远齿技术有限公司
-Shanghai ShangYuan |
| 福建中科康钛材料科技有限公司
-Fujian ZhongKeKang Titanium | 深圳市倍康美医疗电子商务有限公司
-Shenzhen BeiKangMei |
| 航天海鹰 (哈尔滨) 钛业有限公司
-Aerospace Sea Hawk (Harbin) Titanium | 深圳市康泰健牙科器材有限公司
-Shenzhen KangTaiJian |
| 江苏福隆数齿科技有限公司
-Jiangsu Fulong | 江苏创英医疗器械有限公司
-Jiangsu Trausim |
| 南京浦翮医疗技术有限公司
-Nanjing Puhe | 苏州光影口腔医疗科技有限公司
-Suzhou GuangYing |
| 南京星洁医疗科技有限公司
-Nanjing Xingjie | 西安知北信息技术有限公司
-Xian ZhiBei |
| 南宁越洋科技有限公司
-Nanning Yueyang | 长春市铸影植牙科技有限公司
-Chuangchun ZhuYing |
| 珠海乔丹科技股份有限公司
-Zhuhai Jodan | 珠海新茂义齿科技有限公司
-Zhuhai Xinmao |



Others

- 北京大学口腔医院
- 浙江大学
- 浙江工业大学
- 广西医科大学
- 广州中国科学院先进技术研究所
- 山东工业陶瓷研究设计院有限公司
- 华南理工大学
- 江南大学
- 南方医科大学
- 同济大学
- 青岛大学附属医院
- 上海交通大学医学院附属第九人民医院
- 四川大学
- 天津医科大学口腔医院
- 福建医科大学附属口腔医院

16 牙科种植领域典型企业
Typical Company in 3d printing dental implant



江苏创英医疗器械有限公司成立于2010年，总部坐落于江苏省常州市是福隆集团旗下的全资子公司，是集研发、设计、加工、制造、销售口腔科种植牙、种植工具及手术器材的新型高科技企业。

Established in 2010, Trausim is specialized in R&D, design, processing, manufacture, and sales of dental implant and surgical instrument. In order to ensure the product quality, the company collaborates with German research institute, imports the advanced manufacture equipments, cutting edge surface treatment and processing technologies.

三生科技成立于2011年,取得了口腔修复用材料、正畸系统医疗器械产品注册证,与强生(辛迪斯)、创生(史赛克)、康辉(美敦力)等国内外著名医疗器械企业建立起供需关系。

Triup Technology was established in 2011, and is a supplier to medical device companies such as Johnson & Johnson, Stryker, Medtronic and else

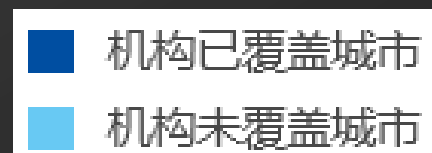
17 牙科领域的典型企业 Typical Company in Dental Industry

拜博集团开设种植复杂病例诊断设计中心 (IDDC)、种植中心、口腔正畸学科联合体、数字化口腔中心、根管治疗中心、牙周治疗及综合齿科治疗中心、舒适牙科诊疗中心、儿童牙科诊疗中心、口腔粘膜病治疗中心、体检中心、德菲国际培训中心、**数字化义齿加工中心**、专业材料研发中心等专业机构。Bybo Group has set up IDDC, Planting Center, Orthodontics Unit, Digital Oral Center, Root Canal Treatment Center, Periodontal Treatment and Comprehensive Dental Treatment Center, Comfortable Dental Clinic, Children's Dentistry Medical Center, Oral Mucosal Disease Treatment Center, Medical Examination Center, Defei International Training Center, Digital Denture Processing Center, Professional Materials Research and Development Center and other professional institutions.



拜博口腔医疗集团
BYBO DENTAL GROUP

—— 联想控股成员企业 ——

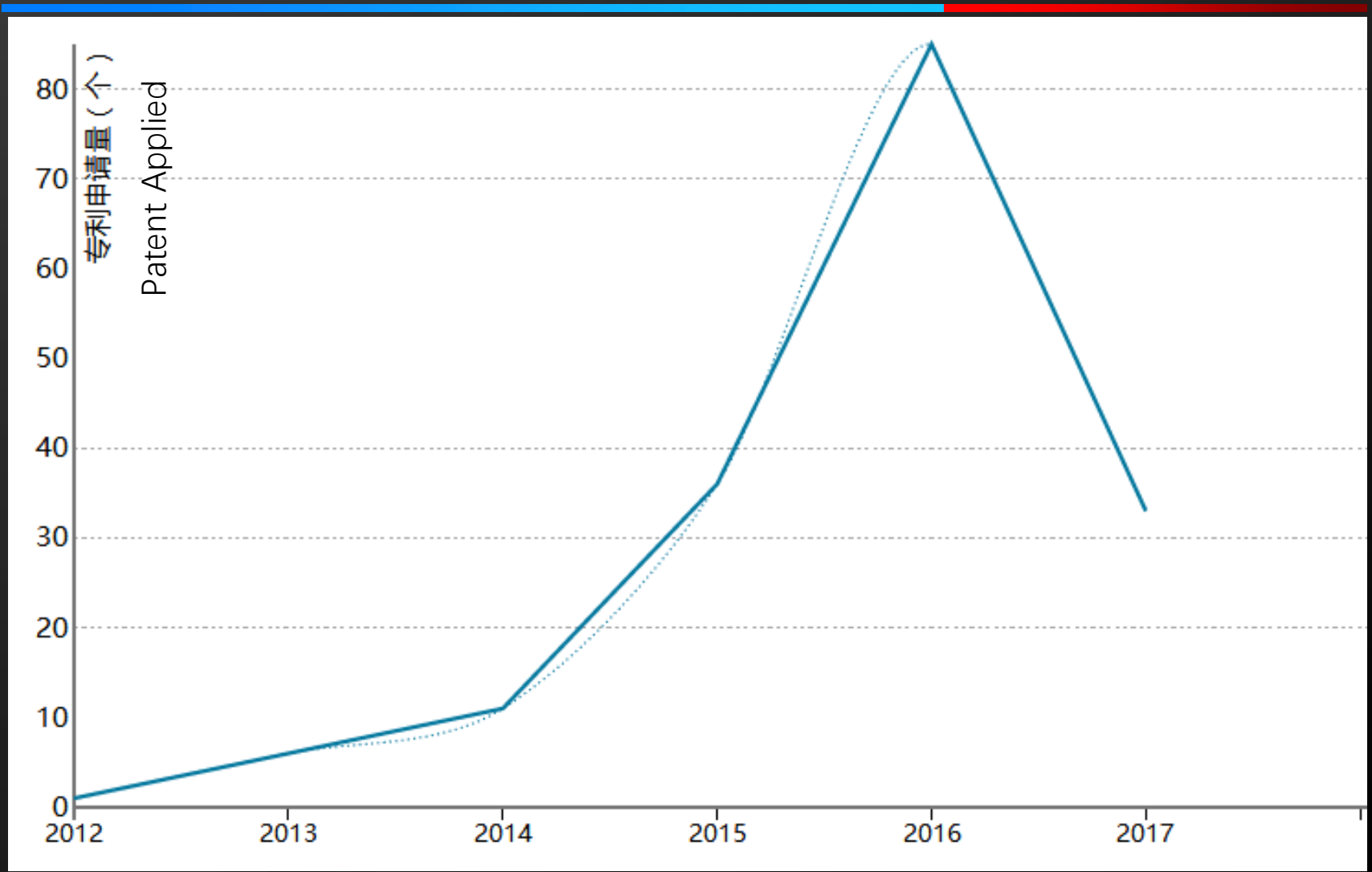


18 牙科专利情况 | 中国 Dental 3d printing patents statistics | China

截止到2017年底，中国目前申请了约172个牙科领域3D打印相关的专利，如：牙齿矫正器、牙冠、种植、模型等。专利类型包括：设备、材料、软件等。

As of the end of 2017, Companies in China have applied around 172 patents regards 3d printing in dental industry, such as: aligner, denture, implant, and module, etc. Patents include systems, materials, software and else.

牙科相关的3D打印应用专利数量/中国 (截至到2017年底)
Patents regards 3d printing in dental industry/ China (As of the end of 2017)





Orthopedics 骨科

Image Courtesy: Lima Corporate

19 骨科植入物市场

Orthopedics Implant Market

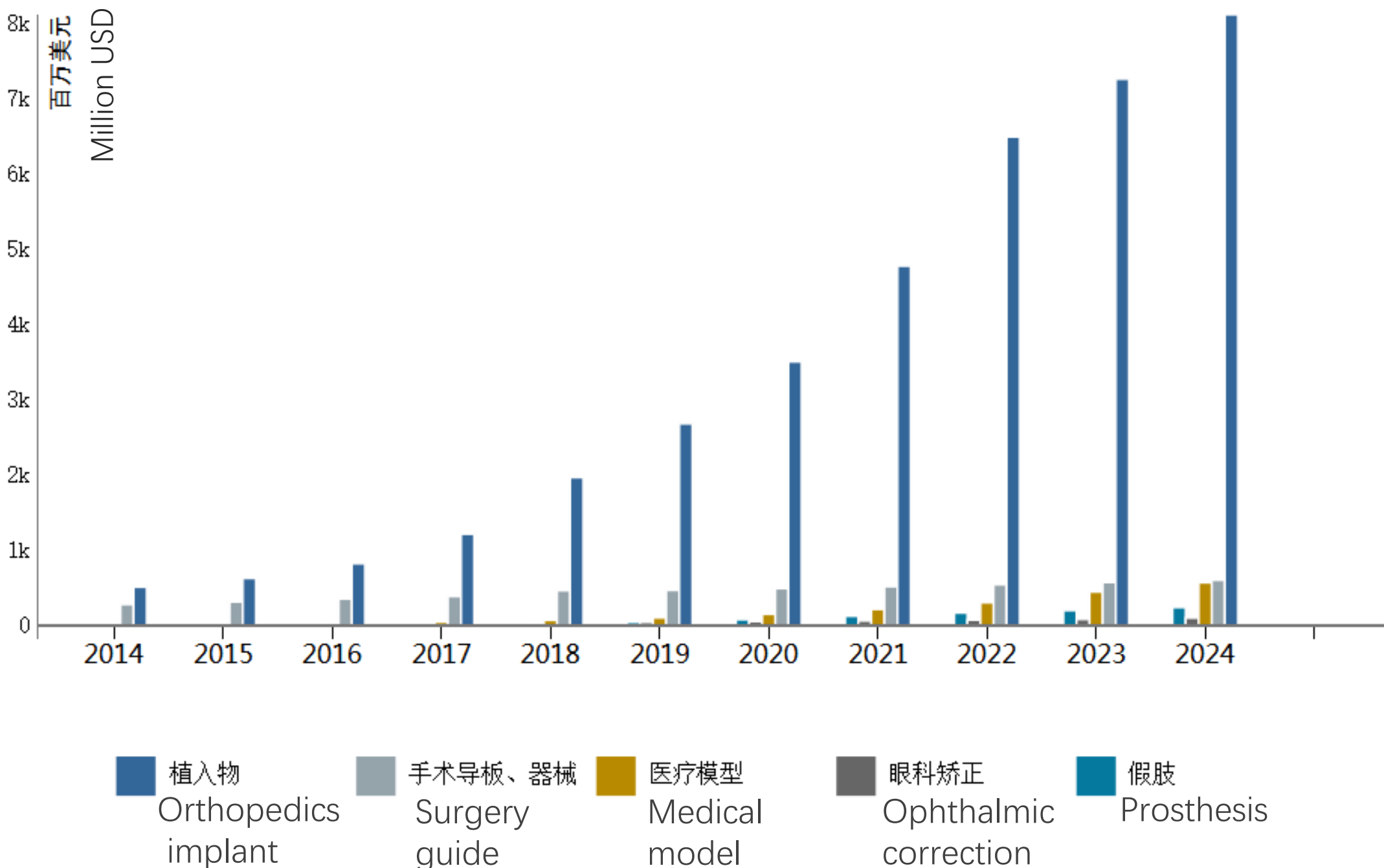
3D打印骨科医疗器械市场规模/全球

3D Printing Medical Device Market Potential / Global

SmarTech 预测，2016年全球3D打印医疗市场规模达12.29亿美元，其中3D打印植入物市场规模达8.23亿美元；2024年3D打印植入物的医疗市场规模达96.39亿美元，其中3D打印植入物的市场规模达81.2亿美元。3D打印植入物是3D打印技术在医疗行业中市场规模最大的应用。

SmarTech predicts that the global 3D printing medical market will reach 1.229 billion U.S. dollars in 2016, of which the market volume of 3D printed implants will reach 823 million U.S. dollars.

The size of the medical market for 3D printed implants in 2024 predicted to be \$ 9.639 billion, with the market for 3D printed implants reaching \$ 8.12 billion.



20 3D打印与骨科植入物 3D Printing Orthopedics Implant Application

中国骨科植入物市场规模在2012年达95.4亿元，2015年达166亿元，2017年预计达到218亿元。（Frost&Sullivan）

现阶段我国创伤类植入物的占比大于关节和脊柱植入物，但关节和脊柱的总量和占比提升是大势所趋。

相比国际市场，中国骨科植入行业整体渗透率低于欧美国家。相比国际品牌，国产品牌在创伤类植入物中的占比相对大，而在关节和脊柱植入物中国产品牌占比低于国际品牌。

China Department of orthopedics implant market size reached 9.54 billion RMB in 2012, and 16.6 billion RMB in 2015. In 2017, this market is expected to reach 21.8 billion RMB.--Frost&Sullivan

At present, the proportion of trauma implants in China is greater than that of joints and spine implants, but the total amount and proportion of joints and spine are increasing.



21 骨科 | 活跃企业
Orthopedics

中国骨科领域活跃企业 (与3D打印相关)
Companies active in 3d printing / orthopedics industry

Companies

北京启麟科技有限公司

广州华钛三维材料制造有限公司

宁波创导三维医疗科技有限公司

深圳市艾科赛龙科技股份有限公司

优适医疗科技(苏州)有限公司

天津正天医疗器械有限公司

北京爱康宜诚医疗器材有限公司

天津市金兴达实业有限公司

贺利氏医疗有限公司

北京纳通科技集团有限公司

闻泰医疗科技(上海)有限公司

苏州云植医学技术有限公司

湖南华翔增量制造股份有限公司

湖南六新智能科技有限公司

华沙整形外科股份有限公司

西安知朴材料科技有限公司

苏州轻金三维科技有限公司

康硕电气集团有限公司

东莞天天向上医疗科技有限公司

浙江科惠医疗器械股份有限公司

广州迈普再生医学科技有限公司

苏州纳晶医药技术有限公司

苏州昕健医疗技术有限公司

武汉康酷利科技有限公司

北京市春立正达医疗器械股份有限公司

株洲普林特增材制造有限公司

常州华森医疗器械有限公司

大连三生科技发展有限公司

辰维医疗科技有限公司

广州市阳铭新材料科技有限公司

直观外科手术操作公司

深圳维度生物医疗科技有限公司

北京形梦信息技术有限公司

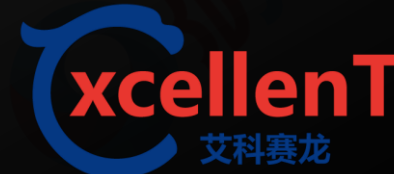
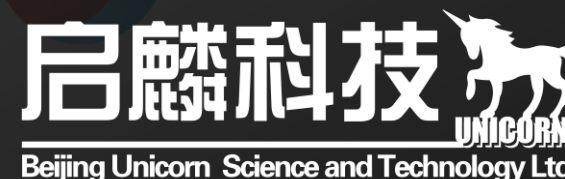
深圳迈普再生医学科技有限公司

牛津医工有限公司

重庆润泽医药有限公司

青岛三帝生物科技有限公司

西安点云生物科技有限公司



22 骨科 | 活跃医院 Orthopedics

中国骨科领域活跃医院 (与3D打印相关) Companies active in 3d printing / Hospitals

Companies

北京大学第三医院

西京医院骨科

第四军医大学唐都医院

首都医科大学附属北京友谊医院

中山大学附属第一医院

上海交通大学医学院附属第九人民医院

天津市天津医院

华中科技大学同济医学院附属协和医院

武汉市普仁医院

南京医科大学第一附属医院

西安市红会医院

中国人民解放军第三军医大学第三附属医院

西安交通大学医学院第二附属医院

南京医科大学附属南京儿童医院

上海市东方医院



3D打印钛合金胸骨植入物

第四军医大学唐都医院联手西安铂力特激光成形技术有限公司利用选择性激光熔化3D打印技术，定制钛合金胸骨，并将其植入胸骨肿瘤患者体内，实现病变胸骨的整体置换。

3D打印胸骨参数与理论值基本一致，且两侧分布有金属3D打印特有的多孔结构，使肌肉、肌腱等软组织贴附和骨长入率大幅提高。



Fourth Military Medical University Tangdu Hospital together with Xi'an Bright applied selective laser melting 3D printing technology to customize titanium sternum, and successfully implanted in the patient who suffered with sternal tumors. The porous structure of metal 3D printing is distributed on both sides, which greatly increases the attachment of soft tissue.

23 骨科 | 活跃科研机构
Orthopedics

中国骨科领域活跃科研机构 (与3D打印相关)
Companies active in 3d printing / Universities and R&D Institutes

Companies

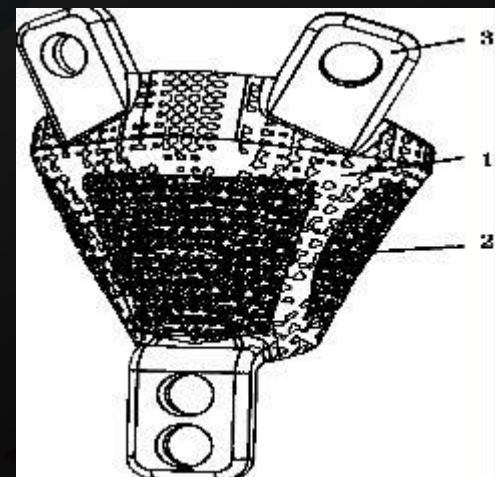
- 华南理工大学
- 浙江工业大学
- 南方医科大学
- 吉林大学
- 西安交通大学
- 中国人民解放军第四军医大学
- 浙江大学
- 西安电子科技大学
- 北京工业大学
- 国家科学研究中心
- 天津理工大学
- 广西医科大学
- 暨南大学
- 哈尔滨理工大学
- 中国科学院苏州生物医学工程技术研究所
- 广州有色金属研究院
- 北京大学
- 广州中国科学院先进技术研究所

华南理工大学的研究包括3D打印植入假体的制造方法又包括骨组织工程支架的制造方法。

通过与金属增材制造相结合，不仅实现个性化植入体的设计及其制造，且能够将多孔结构设计在假体内部，使得骨内细胞容易向假体内部生长，促使病患部位的愈合。

The research of South China University of Technology includes the manufacturing method of 3D printed implant prosthesis and the manufacturing method of bone tissue engineering scaffold.

By combining with metal additive manufacturing, not only the design and manufacture of personalized implants can be realized, but also the porous structure can be designed inside the prosthesis so that the cells in the bone can easily grow inside the prosthesis and promote the healing of the patient.





- 椎体假体
- 脊柱后路装置
- 人工峡部假体
- 单髁膝关节假体
- 肘关节假体
- 股骨假体
- 融合型股骨柄系统
- 胫骨平台垫片
- 髌臼假体
- 截骨可调节垫片
- 人工假体
- 足踝关节融合装置
- 钢板结构
- 聚醚醚酮/石墨纳米复合材料
- 髋髂关节融合器
- 肩关节肱骨柄假体
- 股骨柄假体
- 钢板结构
- 全髋关节假体
- 足踝关节融合器
- 椎间盘假体持器



爱康医疗于2014年7月开发了个性化3D精确构建技术解决方案（「3D ACT解决方案」）。3D ACT解决方案帮助外科医生模拟和规划手术，简化手术过程，提供个性化手术器械及手术前选定内植入物，并显著改进患者的康复进度。爱康医疗的常规产品和3D打印产品都受到食药监局监管，目前公司的三个3D打印产品，包括髋关节置换内植入物、脊柱椎间融合器及人工椎体，是中国首个及唯一经食药监局批准的3D打印骨科内植入物产品。

In commercialized medical implant printing, currently Beijing Aikang is the Chinese market leader. In August 2015, Aikang received the CFDA approval for its 3D ACT artificial hip joint system based on 3D metal printing technology and in July 2016 for a vertebral cage based on 3D ACT technology. It is also the first metal 3D printed interbody fusion cage product licensed by the CFDA in China. 3D ACT technology is a combination of various technologies from clinical medicine, computer technology, material science and mechanical design, such as Electron Beam Molten Metal 3D Printing Technology (EBM) and precision 3D reconstruction technology.

25 骨科领域典型企业 Typical Company in 3d printing implant industry

www.huatai3d.com

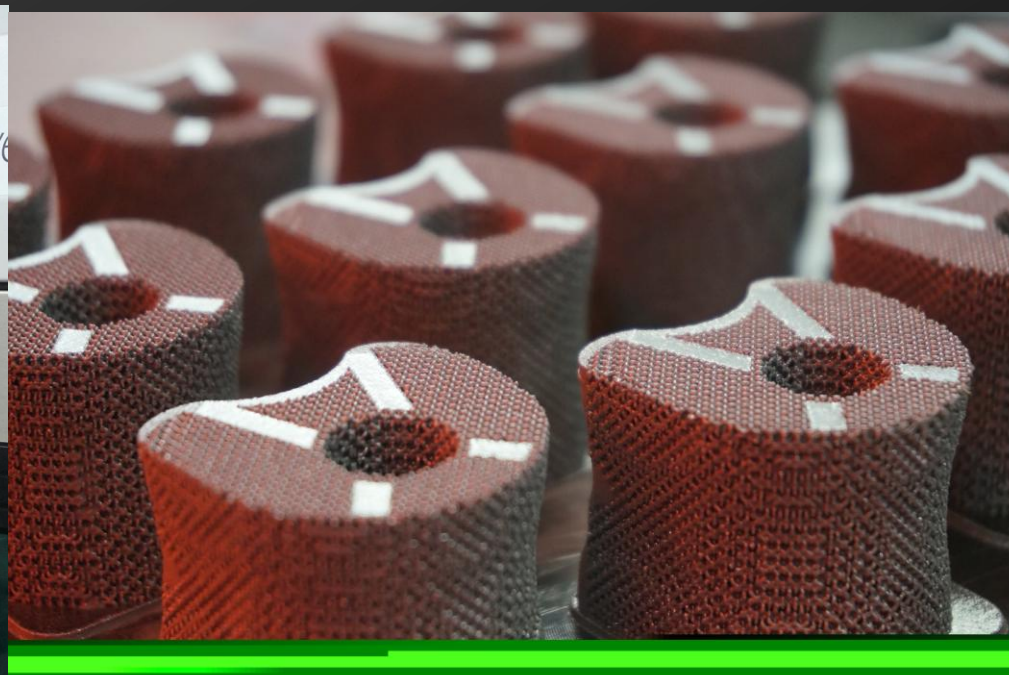
2018年2月7日华钛三维与南方医院脊柱骨外科联合莫纳什大学增材制造研究中心合作的3D打印个性化“人工椎体/ 腰间盘”植入手术成功实施。

February 7, 2018, Hua Tai 3D together with the Southern Hospital's spinal surgery and the Monash University Additive Manufacturing Research Center successful implemented the 3D printing personalized artificial vertebral body / lumbar intervertebral disc implantation.

华钛三维所申请的3D打印应用专利2017 3D printing related patents HuaTai applied in 2017

专利号: CN107647942A

一种金属骨小梁及包含所述金属骨小梁的骨骼植入物
A metal trabecular and a bone implant comprising the metal trabecular





Foundry 铸造

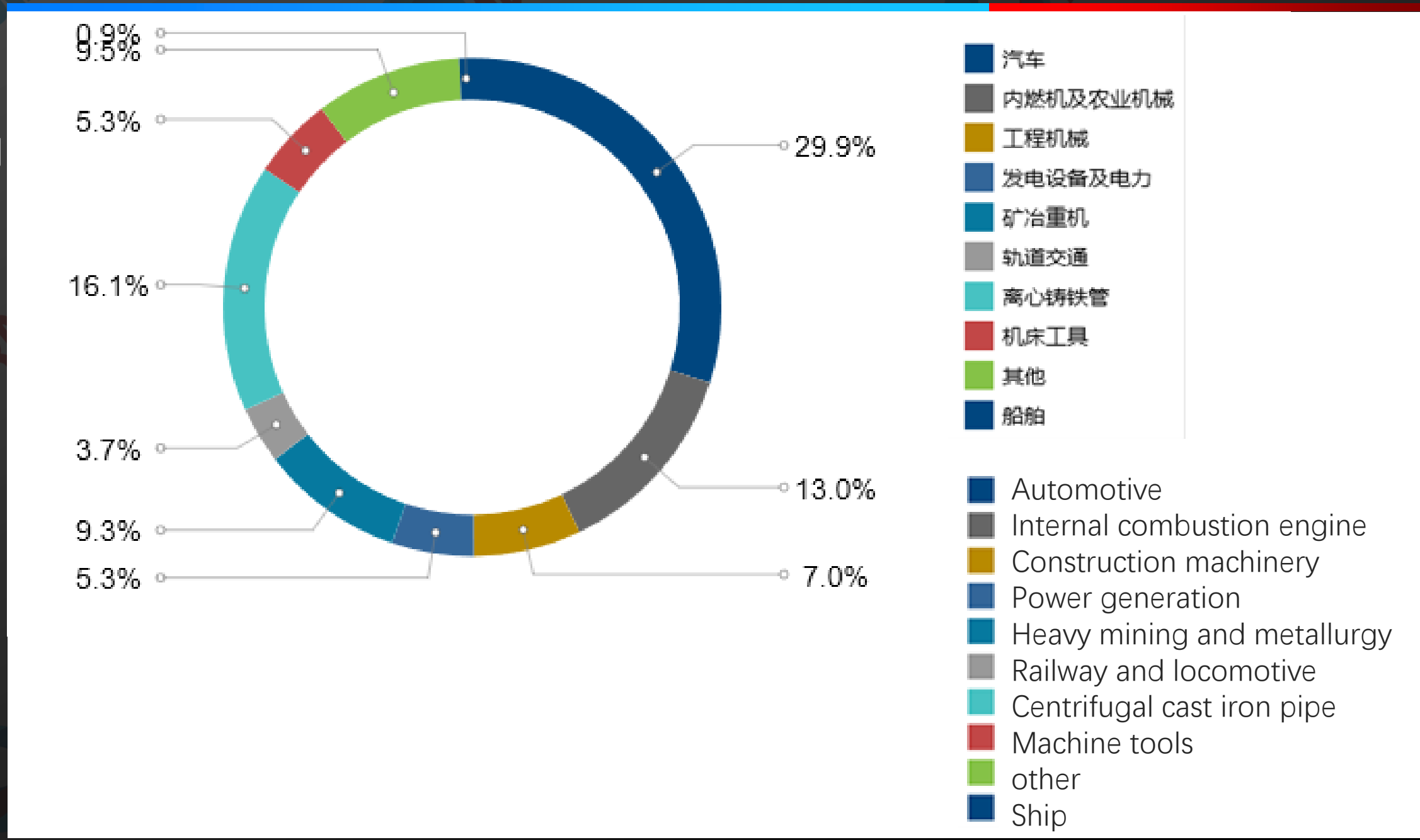
26 铸造业 Foundry Industry

2016 年度，汽车领域铸件用量占国内铸件总需求量的近三分之一，达29.90%，内燃机及农业机械用量为13.03%，离心铸铁管用量为16.10%，矿冶重机用量为9.32%，工程机械用量为6.99%，上述五个主要工业领域的铸件用量占到总需求量的75%左右。

The amount of castings in the automotive sector accounted for nearly one-third of the total domestic demand for castings which occupied around 29.90% of the total castings; within which the internal combustion engine and agricultural machinery consumption was 13.03%; the amount of centrifugal cast iron pipes was 16.10%; the mining and metallurgy heavy machine usage was 9.32% The amount of construction machinery is 6.99%, and the casting consumption of the above five major industrial fields accounts for about 75% of the total demand.

图表：我国2016年各领域铸件用量占比

Chart: Industry accounted for the amount of casting (China, 2016)



Reference: Foundry Association

上游
Upstream

- 1 通过3D技术打印熔模
3D print master pattern



中游
Mid-Stream

- 1 通过熔模覆耐火材料，
然后烧掉熔模获得型壳
Dewax to get the
investment mould

- 2 通过3DP技术打印砂模
3DP print sand mould



下游
Down-Stream

1

2

- 1 熔融金属通过砂模浇铸成型
Metal casting

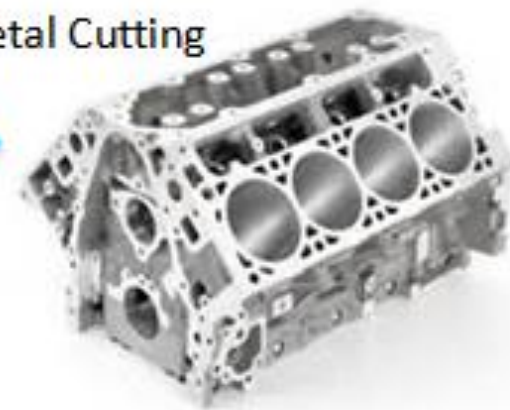


3

- 3 金属3D打印技术打印
Metal 3D Printing

产品
Product

- 机加工
CNC Metal Cutting



28 铸造
Foundry

中国铸造领域活跃企业 (与3D打印相关)
Companies active in 3d printing casting industry

3D Printing Companies	
宁夏共享模具有限公司	NingXia Kocel
共享装备有限公司	Suzhou Meimai
宁夏共享化工有限公司	Beijing Longyuan
苏州美迈快速制造技术有限公司	Wuhan Huake
北京隆源自动成型系统有限公司	Shanxi Hengtong
武汉华科三维科技有限公司	Machinery Research Institute
陕西恒通智能机器有限公司	of advanced manufacturing
机械科学研究总院先进制造技术研究	technology research center
中心	Kangshuo
康硕电气集团有限公司	Sengyuan Additive
贵州森远增材制造科技有限公司	
辽宁森远增材制造科技有限公司	

Foundry Application Market	
四川南车共享铸造有限公司	Nanche Kocel
广西玉柴机器股份有限公司	Guangxi Yu Diseal
上海大量电子设备有限公司	Shanghai Daliang
上海大量自动化有限公司	Shanghai Daliang Automation
中车长江车辆有限公司	Zhongche Changjiang
十堰长江造型材料有限公司	Shiyan Changjiang
吉野石膏株式会社	Yoshino Gypsum
宁波通达精密铸造有限公司	Ningbo Tangda
无锡范尼韦尔工程有限公司	Wuxi Vane
昆明理工大学	Kunming University of Science
浙江省机电设计研究院有限公司	and Technology
第一拖拉机股份有限公司	Zhejiang Mechanical and
连云港源钰金属制品有限公司	Electrical Design Institute
	First Tractor
	Lianyungang Yuanyu Metal

29 铸造领域典型企业 Typical Company in 3d printing foundry industry



苏州美迈(美唐科技控股)于2015年推出快速铸造业务,具备缸体、缸盖、缓速器等复杂砂铸件的快速生产能力,2016年苏州美迈建成铸造车间,具备独立的铝合金铸造能力。同年,苏州美迈引进德国MK Cyclone快速制壳设备,建成精密铸造能力,随后苏州美迈推出2周首件的快速铸造服务,开始批量交付大客户快速铸件。

In May 2015, Suzhou Meimai launched the rapid casting business with the rapid production capacity of complex sand castings such as cylinder blocks, cylinder heads and retarders. In 2016, Meimai completed a foundry workshop with independent aluminum alloy Casting ability. In the same year, Suzhou Memei introduced the MK Cyclone rapid shell making equipment from Germany to build its precision casting capability. Subsequently, Suzhou Memei launched its rapid casting service within 2-weeks and started mass delivery of large-scale customers' rapid castings.



采用喷墨砂型3D打印技术可以直接打印出铸造所需的砂型和砂芯,无需传统木模/芯盒等工装模具。可以使产品试制周期从3个月缩短至3周,从而大大增加开发迭代次数,显著提高批量生产成品率和质量。并且打印出的砂型初始强度高,使得水套等复杂薄壁砂芯破壳后处理更容易。

Applying binder jetting 3D printing technology to produce sand mould and sand core can shorten the product trial cycle from 3 months to 3 weeks.



Courtesy: FAW
来源: 一汽铸造、
美唐机电

30 铸造领域典型企业

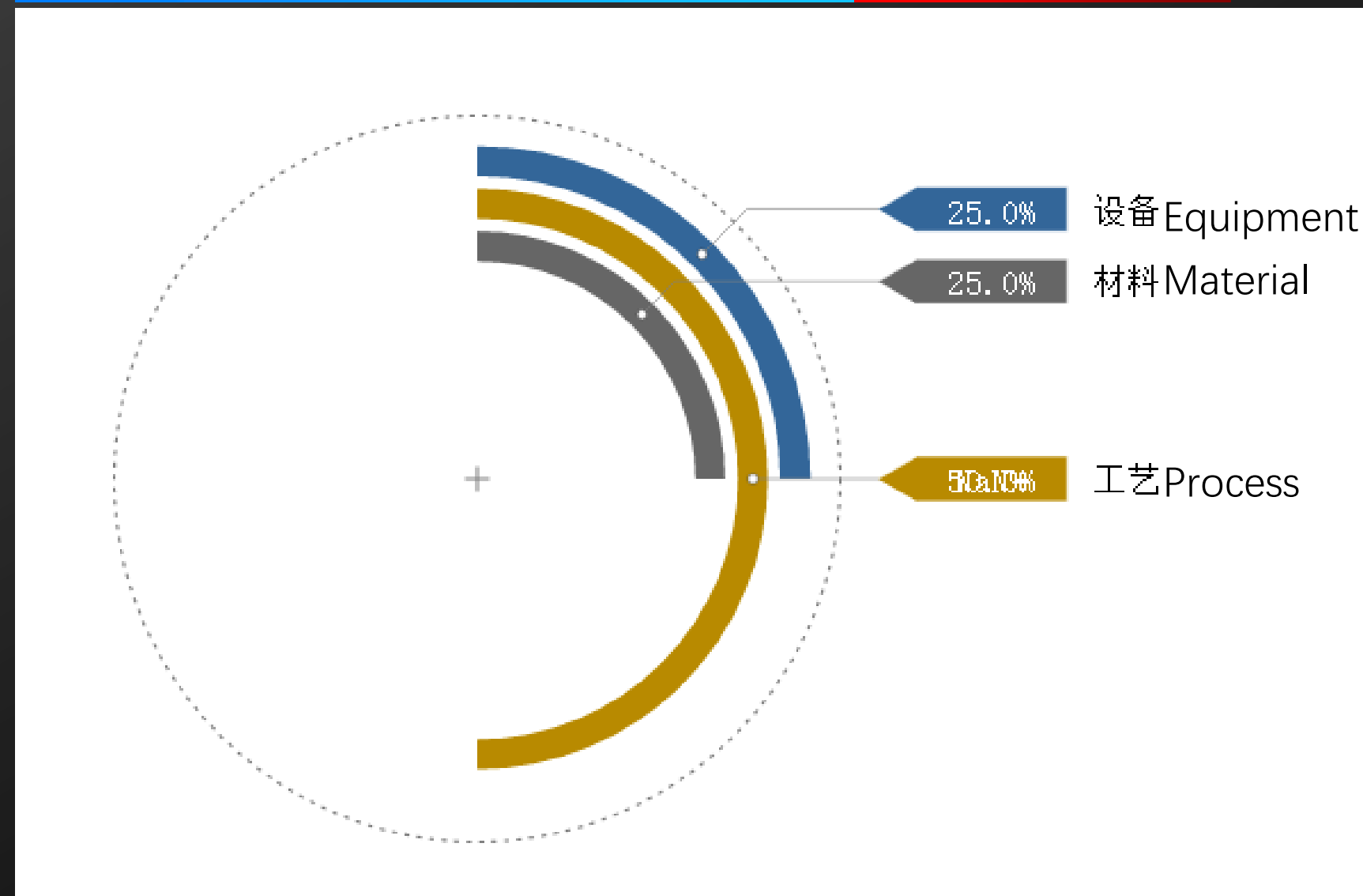
Typical Company in 3d printing foundry industry



2013年-2017年，共享集团共申请铸造3D打印相关专利36个，其中，用于铸造的3D打印设备和材料相关专利各占25%，与铸件3D打印相关的工艺专利占50%。共享集团既是铸件生产企业，也是铸件消费企业，其子公司四川南车共享铸造有限公司，申请了与轨道机车金属零件铸造相关的专利，这些专利中涉及到3D打印技术在铸件制造中的应用。

From 2013 to 2017, Kocel applied for a total of 36 3D printing patents, from which 50% is related to process of 3D printing casting mould. Kocel Group is both a casting manufacturer and a consumer casting company. Its subsidiary, Sichuan CSR Kocel Casting Co., Ltd., applied for patents related to the casting of metal parts for locomotives. These patents involve the application of 3D printing technology in the manufacture of castings.

共享集团所申请的3D打印应用专利 (2013-2017)
3D printing related patents Kocel applied(2013-2017)



31

制造企业的增材制造中心/铸造

Additive Manufacturing Center / Heavy Industry/Casting

北京京城重工机械有限责任公司是北京京城机电控股有限责任公司旗下的专业化的工程机械设备制造与服务供应商，是集工程机械产品开发、制造、销售为一体的法人实体，同时还拥有多家工程机械企业的股权。公司于2001年在北京注册成立，注册资本7.4亿元人民币，总资产逾14亿元。目前拥有六个生产基地，八家控股和参股公司，其中包括与日本、韩国、意大利等国众多知名厂商的合资公司四家。Beijing Jingcheng Heavy Industry Co., Ltd. is an independent company under Beijing Jingcheng Mechanical and Electrical Holding Company. It specializes in manufacturing, selling and exporting construction machineries. It is also the share holder of several holding companies in construction machinery fields. The fixed assets of JCHI are 600 million RMB and the total assets exceed 1 billion RMB. JCHI has six subsidiaries around Beijing with modern technologies and capacities and more than 700 employees.



Additive Manufacturing Center

Installed Systems: Binder Jetting 3D Printing Technology

安装的设备：粘结剂喷射3D打印技术

Materials: Sand

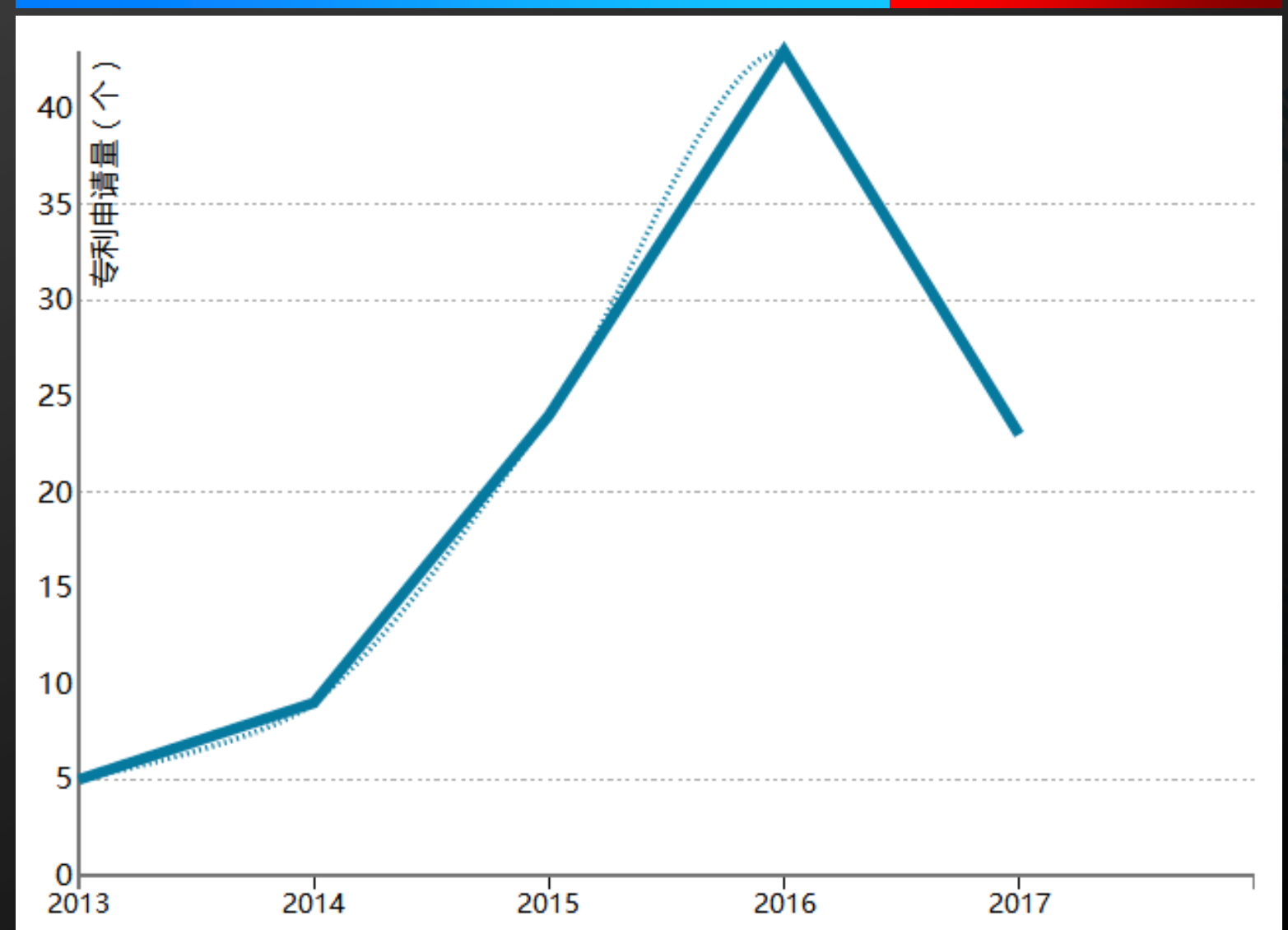
材料：砂子

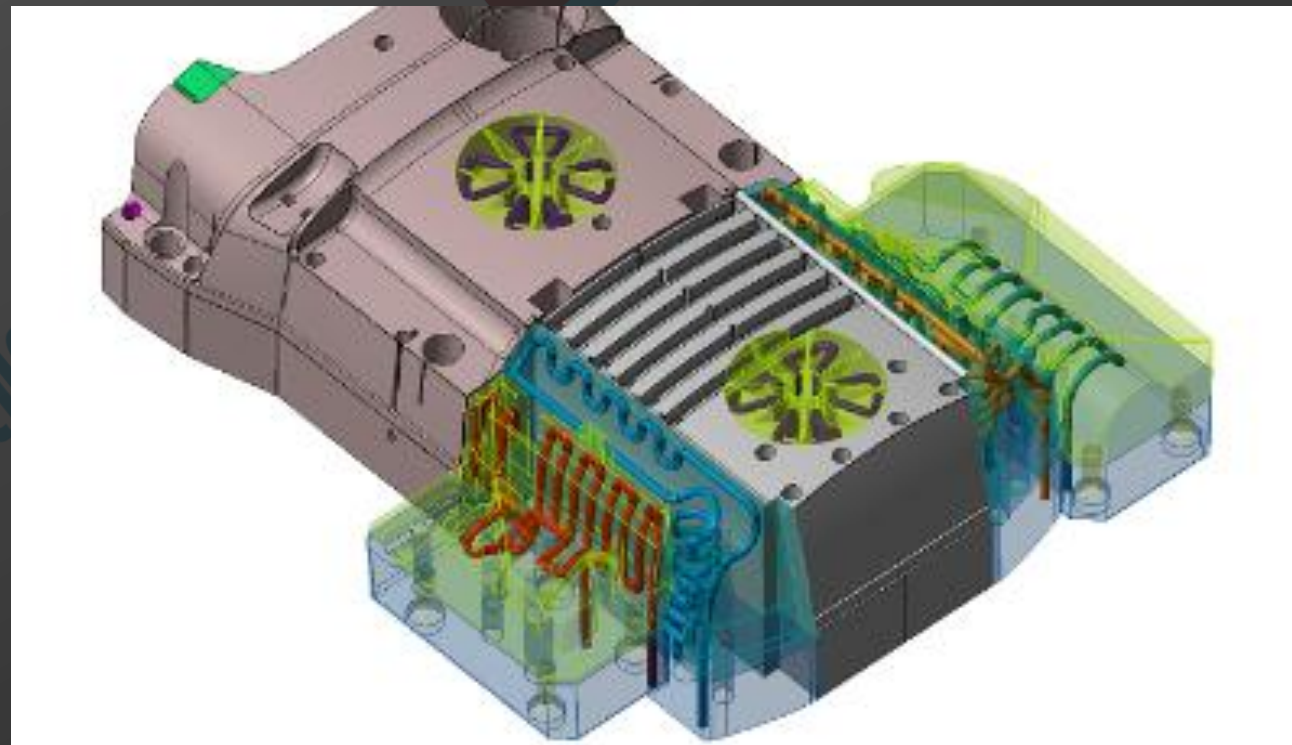
32 铸造 | 3D打印领域的知识产权 Foundry | Patents related to 3d printing

截止到2017年底，中国目前申请了约101个工业品3D打印铸造相关的专利，如：汽车发动机、飞机叶轮、机匣、叶轮等，不包括与牙科、艺术品3D打印铸造相关的专利。专利类型包括：与铸造相关的3D打印材料、3D打印设备、设备零部件，以及通过3D打印技术制造铸件的工艺。

As of the end of 2017, Companies in China have applied around 101 patents regards 3d printing in foundry industry, such as: car engine, aircraft impeller, casing, impeller, etc. Patents include casting-related 3D printing materials, 3D printing equipment, equipment components, and processes for making castings through 3D printing technology.

铸造业相关的3D打印应用专利数量/中国 (截至到2017年底)
Patents regards 3d printing in foundry industry/ China
(As of the end of 2017)





Die&Mould 模具

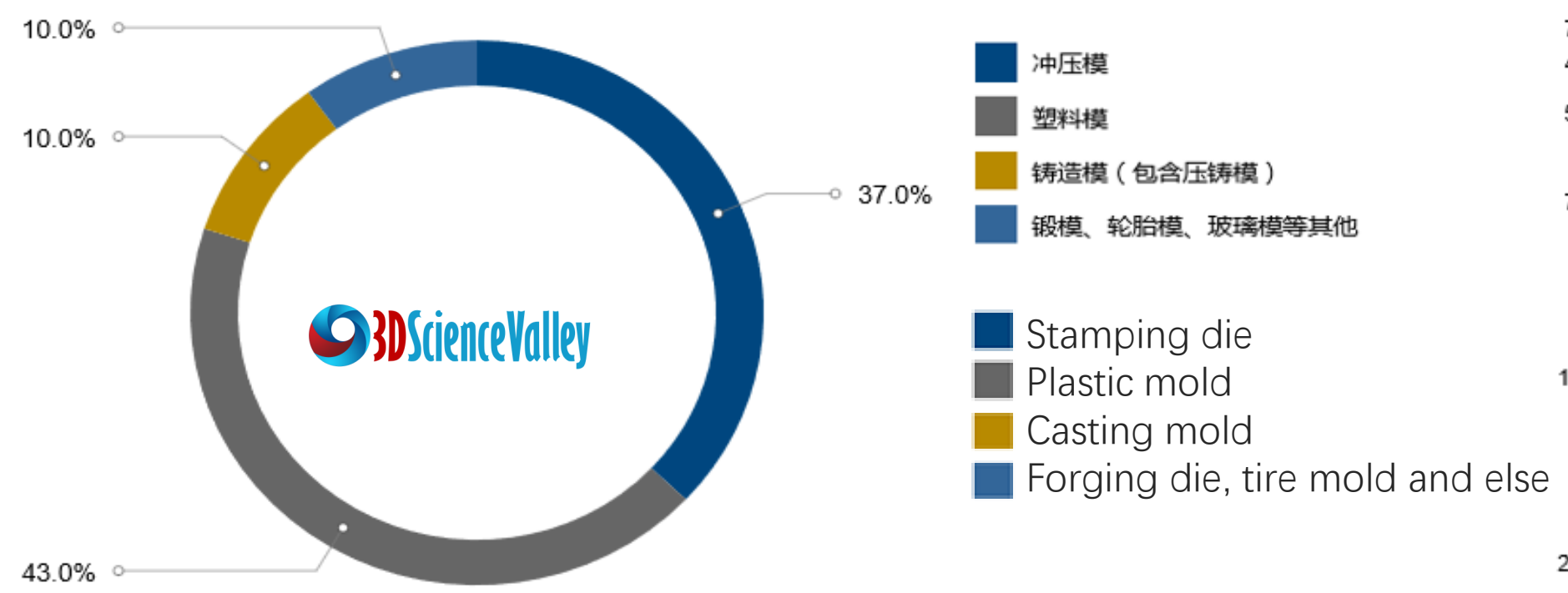
Image Courtesy: Renishaw

33 模具 Die & Mould

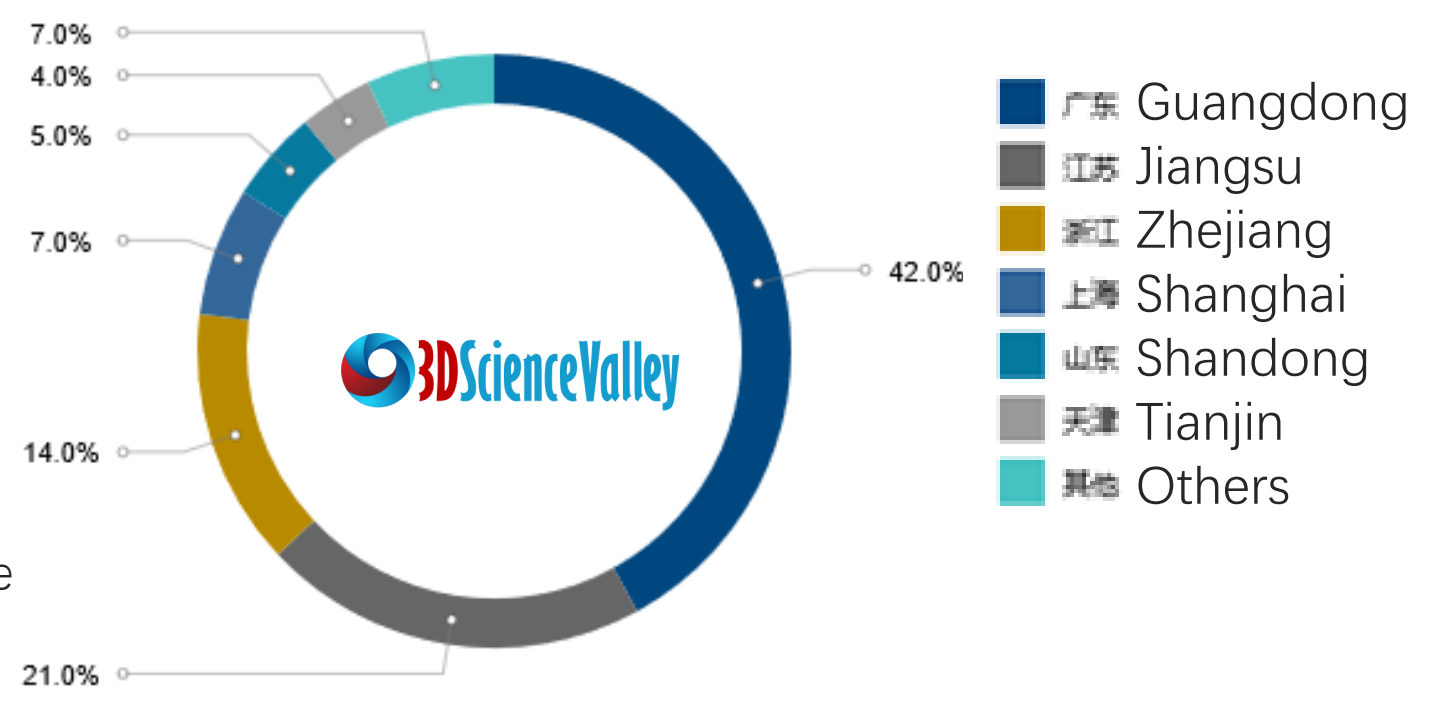
中国模具产业冲压模约占37%，塑料模约占43%，铸造模（包含压铸模）约为10%，锻模、轮胎模、玻璃模等其他类模具占10%。与工业发达国家的模具产业结构基本一致。中国模具行业工业总产值有望从2015年到2020年逐渐达到年产值1464亿元，1502亿元，1569亿元，1628亿元，1711亿元，1795亿元，单位为人民币。3D打印可渗透的市场预计在30亿人民币（2020年），该数据包括3D打印设备、材料、模具产品的3D打印服务。

For Die&mould industry, stamping die accounted for 37%, injection plastic mould accounted for 43%, casting mold (including die casting) accounted about 10%, forging die, tire mold, glass mold and other molds accounted for 10%. China's die&mould industrial output is expected to gradually reach an annual output value of 146.4 billion yuan, 150.2 billion yuan, 156.9 billion yuan, 162.8 billion yuan, 171.1 billion yuan and 179.5 billion yuan from 2015 to 2020(in RMB). The 3D printing market related to die&mould application is estimated at 3 billion yuan (2020).

中国模具产业结构



中国模具产业集中度情况

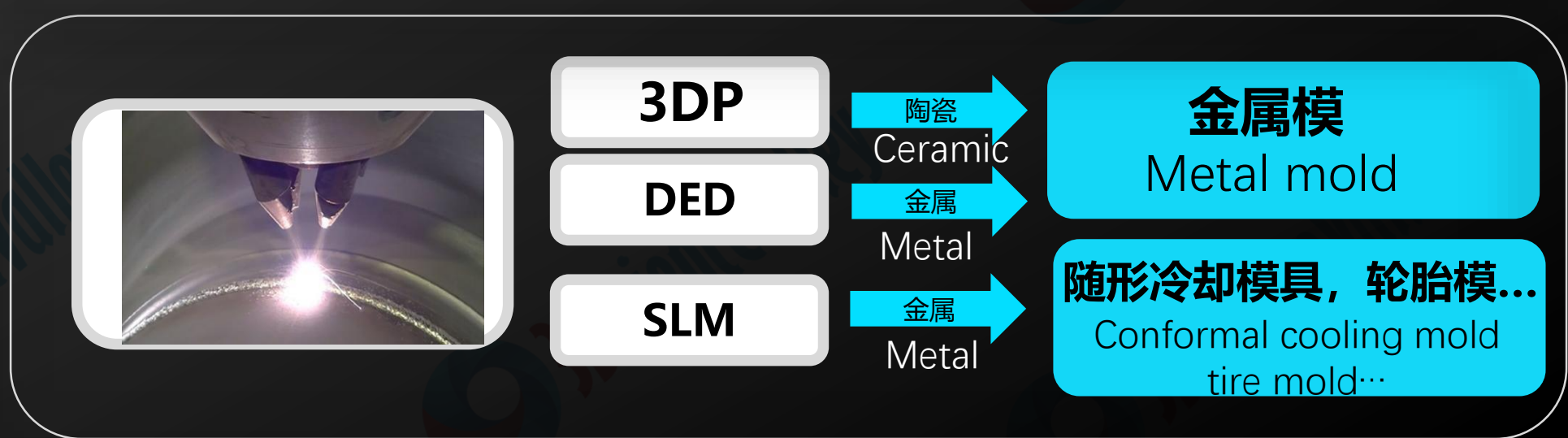
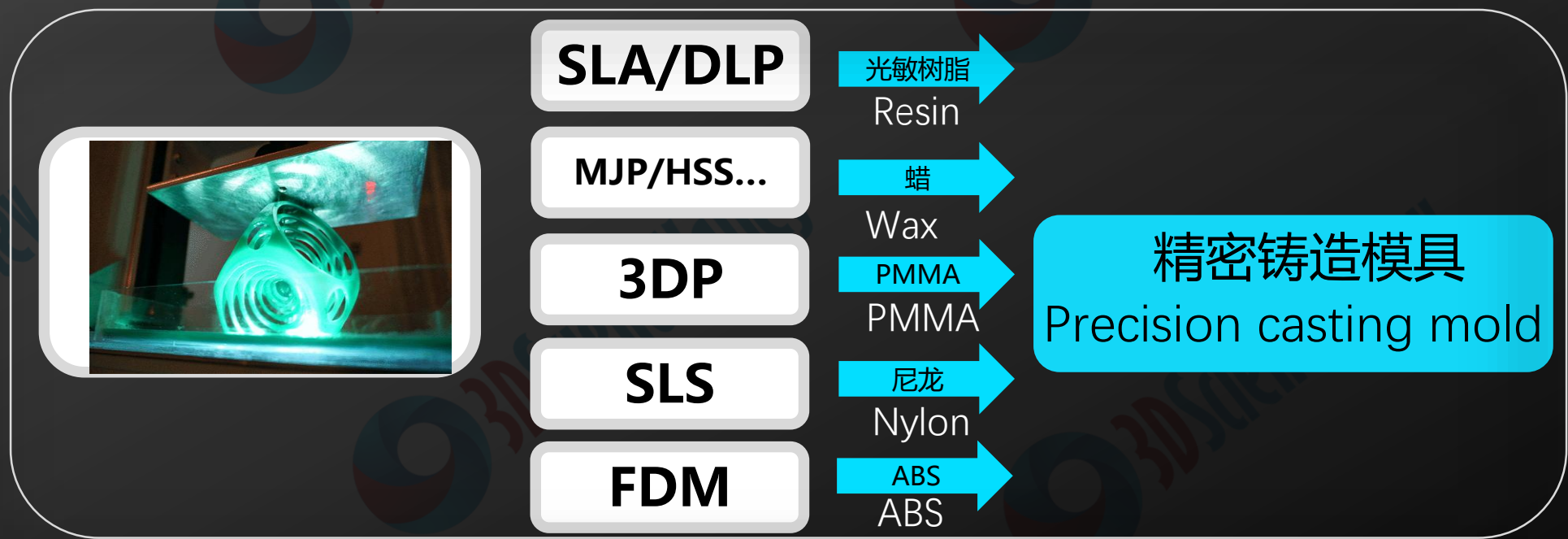


34 3D打印与模具制造

3D printing in Die & Mould application

3D打印制造使冷却通道摆脱了交叉钻孔的限制。可以设计内部通道更靠近模具的冷却表面，并具有平滑的角落，更快的流量，增加热量转移到冷却液的效率。

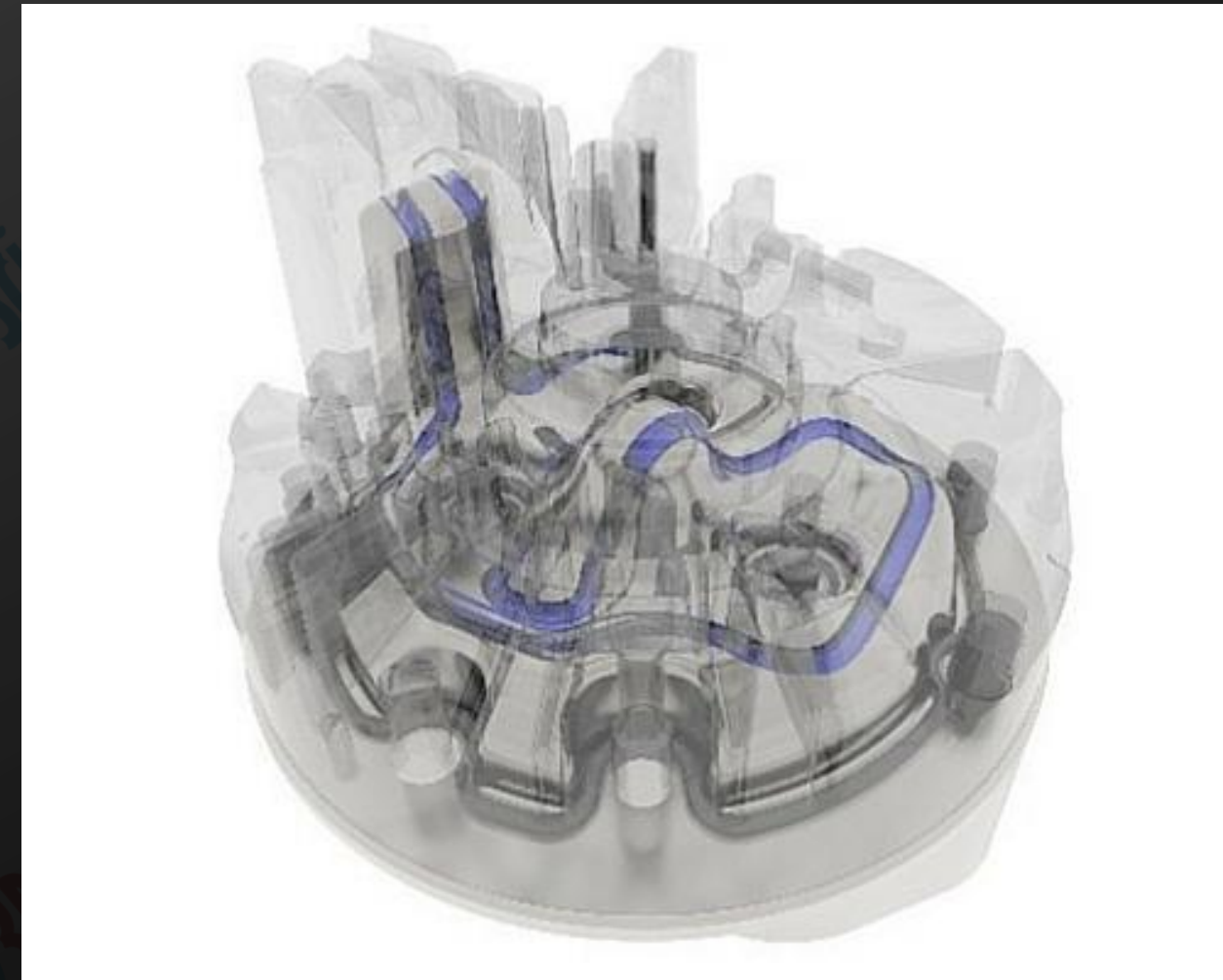
3D printing frees the cooling channels from cross-drilling restrictions. The internal channels can be designed to be closer to the cooling surface of the mold, with a smooth corner, faster flow, and increased efficiency of heat transfer to the coolant.



35 制造企业的3D应用**Additive Manufacturing Application inside of the Manufacturers**

洗衣机波轮模具中心镶块内具有采用3D打印成型的随形冷却水路；沿冷却水流向，随形冷却水路包括进水段水路、冷却段水路和出水段水路，进水段水路和出水段水路位于环形底座内，相邻镶块齿内的冷却段水路依次连通。通过在模具型腔镶块上对应波轮中心密集筋位的部位设置中心镶块，中心镶块上通过3D打印技术成型随形冷却水路，则冷却水路可以根据波轮中心密集筋位的形状随意设计，做到随形冷却，保证产品冷却均匀，减小产品变形。

In the center of the washing machine, the pulsator mold has a conformal cooling water passage formed by 3D printing. Along with the cooling water flow, the cooling water passage includes a water inlet passage, a cooling water passage and a water outlet passage. The water inlet passage and water outlet passage located in the annular base, the cooling water in the adjoining inserts communicated with each other. The center insert can be shaped by the 3D printing technology to form the conformal cooling water path, the cooling water path can be arbitrarily set according to the shape of the dense tendons in the center of the pulsator design, so that with the shape of cooling, to ensure uniform cooling of the product, reducing product deformation.

Haier

典型企业与研究机构

Typical Companies and R&D Institutes

36 打印服务 | 典型企业
3D Printing Service / Typical Company



铂力特在3D打印服务市场占据最大的市场份额，构建了从金属粉末到设备以及3D打印应用的全面实力。

Bright Laser occupied the largest market share of the 3d printing service market in China with full competence from metal powder to equipment manufacturing and 3d printing.



专注于粉末床金属熔融3D打印技术，尤其在随形冷却模具的3D打印方面。正在向塑料3D打印领域拓展。Ureal has developed years of competence in powder bed metal 3d printing, especially strong in conformal cooling mould manufacturing. Now they are expanding to plastic 3d printing application.



37 打印耳机
3D Printed earphone

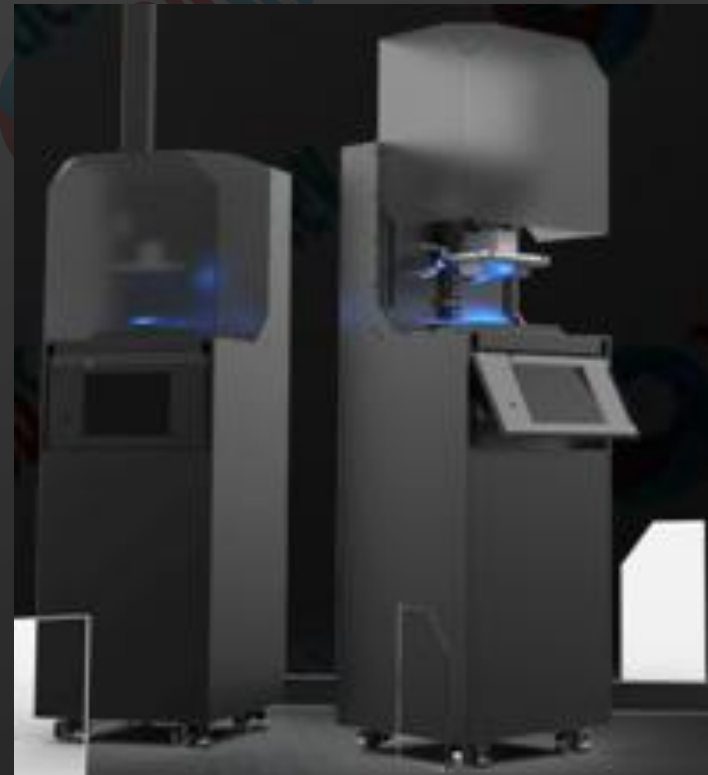
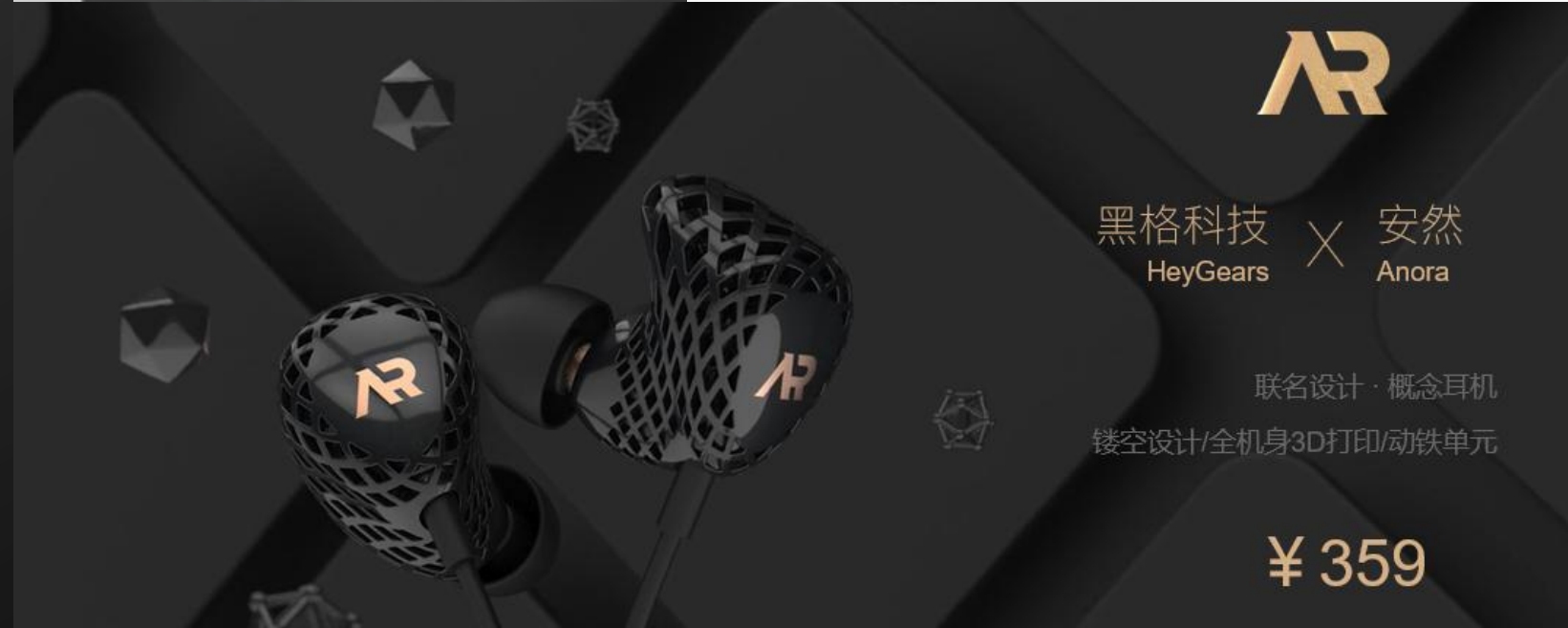
黑格的3D打印耳机来自于自主研发的3D 打印机得到了远超传统 3D 打印精度、具备黑格知识产权的 3D 打印机。

打印精度高达 25 μ m, 仅为头发丝的 1/4, 远超传统 3D 打印机的 200 μ m.

3D 打印一体化成型, 无缝腔体降低了腔体的共振效应, 同时大幅减少声音底噪.

Heygears earphone has achieved very successful market response. Heygears has independently developed their own 3D printers which achieved far more accuracy than the traditional 3D printers. Print accuracy up to 25 μ m, only 1/4 of the hair, this set a new benchmark compared with the traditional 200 μ m accuracy level.

3D printing integrated molding delivered seamless cavity results which reduces the resonance effect of the cavity

黑格科技 HeyGears × 安然 Anora

联名设计 · 概念耳机
镂空设计/全机身3D打印/动铁单元

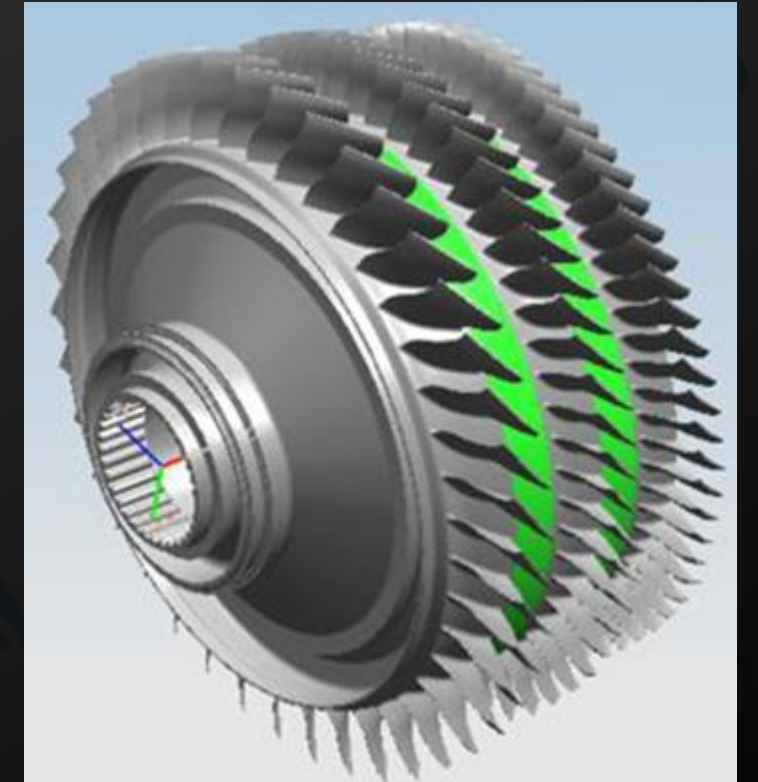
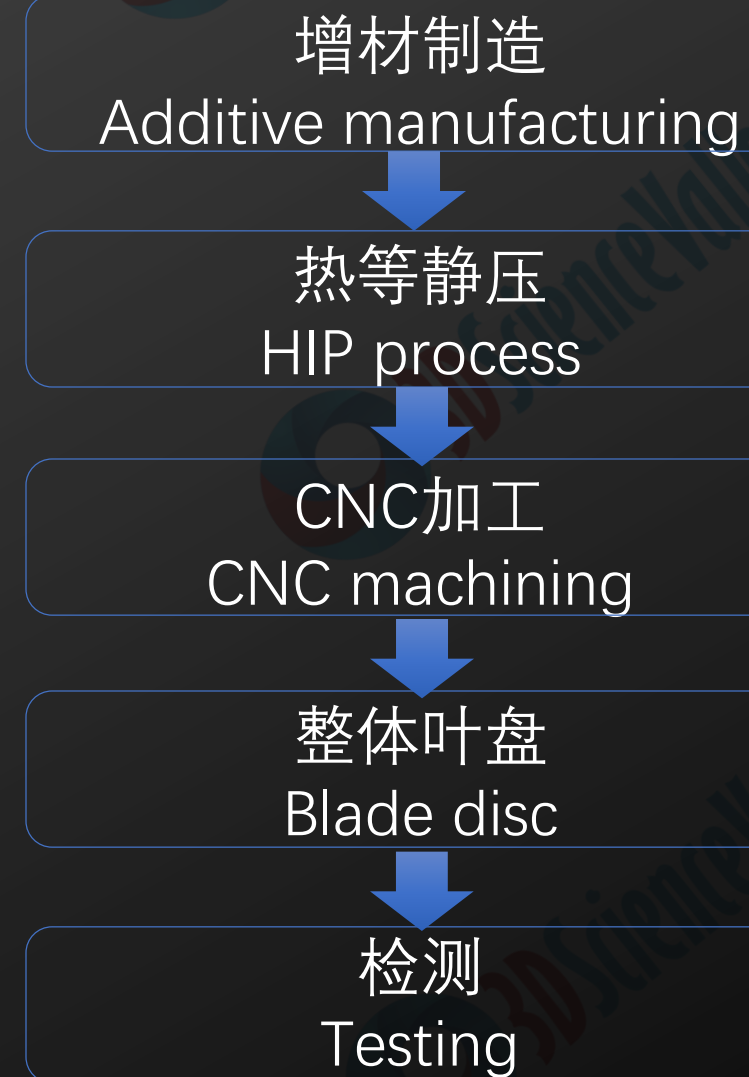
¥ 359

实现利用增材制造在轮毂上直接制备多级叶片，与传统锻件加工整体叶盘相比，可以实现提高材料的利用率，同时减少机械加工时间，降低整体叶盘加工难度，最终实现串联整体叶盘的整体制造，进而提升压气机的工作效率。

AECC has applied additive manufacturing process on the manufacturing of multi-stage blades. Compared with the traditional forging method, additive manufacturing can improve material utilization, while reducing machining time and reduce the overall blade disc processing challenge and also enhancing the working efficiency of the compressor.



中国航发商用航空发动机有限责任公司
AECC COMMERCIAL AIRCRAFT ENGINE CO.,LTD



39 核电 3D Printing / Nuclear power station

2018年，南方增材制造为中国广核集团通过金属3D打印技术研发制造出的压缩空气生产系统制冷机端盖，在我国大陆首个百万千瓦级大型商业核电站——大亚湾核电站实现工程示范应用。这标志着中广核开展的3D打印技术在核电站备件及零部件制造、维修过程中的关键技术研究取得突破性进展。

In 2018, Southern China additive manufacturing Co., Ltd. produced the compressor cover for China Guangdong Nuclear Power Group through metal 3D printing technology. This is the first 3d printed component installed in the million-kilowatt-class large-scale commercial nuclear power plant in mainland China- Daya Bay Nuclear Power Station . This marks a breakthrough in the research on the key technologies in the process of manufacturing and maintaining nuclear power plant spare parts by 3D printing technology.

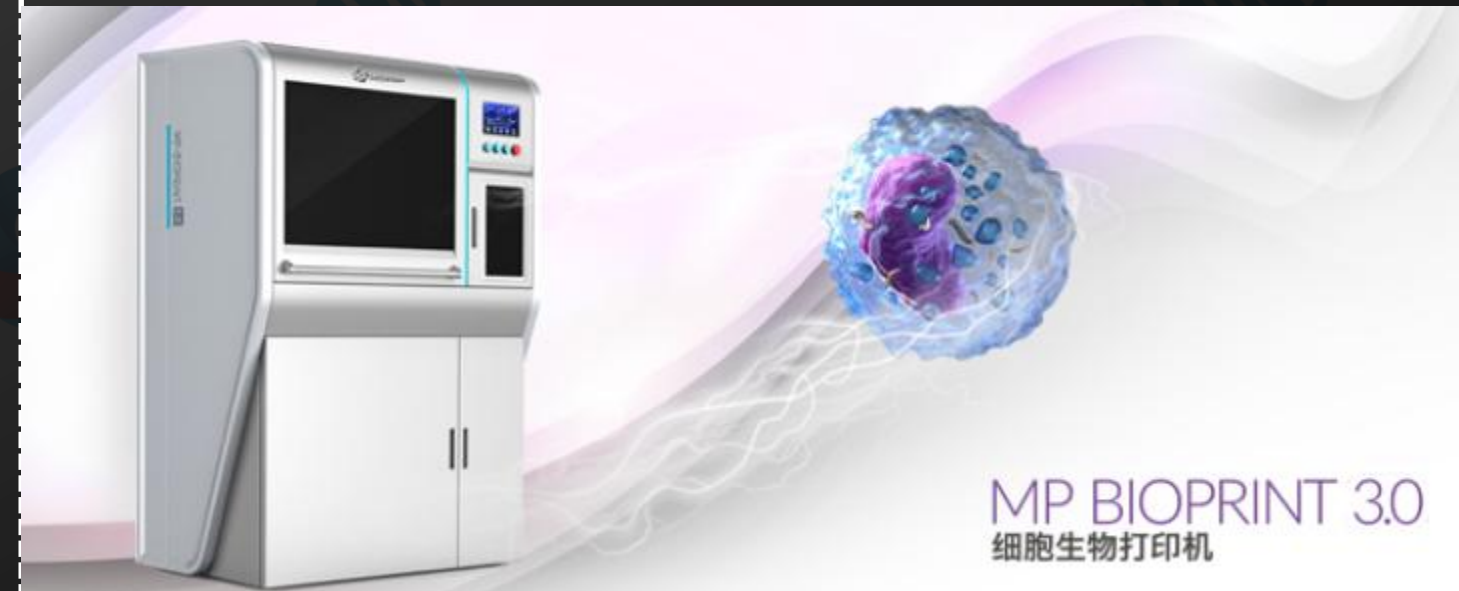


迈普医学突破性地开发出中国首个进入全球高端市场的再生型植入类医疗器械产品——睿膜®/ReDura®。该产品具有全球独立知识产权及显著的技术优势，获得欧盟CE认证、中国CFDA以及印度注册证等，代表中华民族高新技术品牌进入全球高端植入式医疗市场销售。目前，睿膜®已在全球五十多个国家和地区应用数万例。

MEDPRIN's first product ReDura® is a biomimetic-synthetic-absorbable dural substitute with CE and CFDA registration certificates. The material has been widely applied in more than 50 countries on tens of thousands of cases, and is considered as the dura mater (ridge) membrane closest to a patient's autologous cells with the best repair effect. In addition to ReDura®, MEDPRIN is developing a dozen of human tissue repair products, including a personalized skull and maxillofacial repair system, a female pelvic diaphragm repair system, tensionless urethral slings, hernia repair pieces, artificial skin, blood vessels and ligaments. These are laying the technical foundation for the future development of more complex and advanced artificial tissues and organs.

**MEDPRIN**

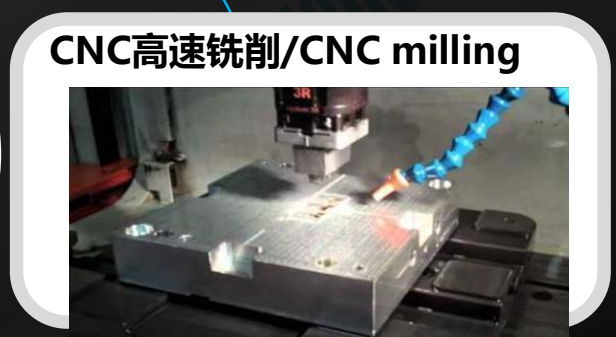
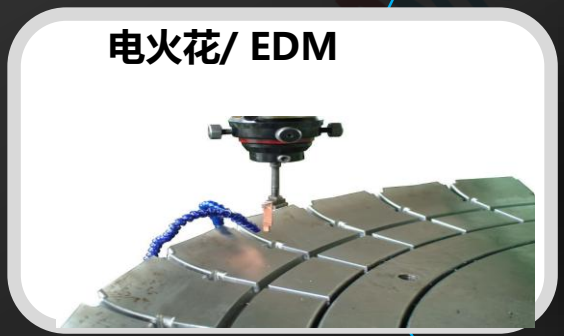
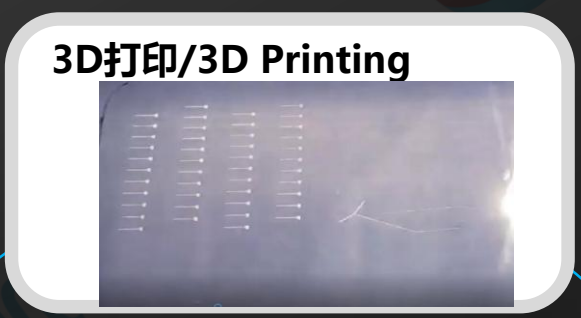
迈普医学



41 3D打印轮胎模具 3D Printing Tire Mould

豪迈现已成为世界轮胎模具研发与生产基地，年产各类轮胎模具20000套，与全球前75名轮胎生产商中62家建立了业务关系，是世界轮胎三强米其林、普利司通和固特异的优质供应商，轮胎模具国际市场占有率25%以上，轮胎模具出口额占国内同类产品的90%以上。豪迈引入了铂力特等3D打印设备进行轮胎模具的研发工作。

Himile has become the global tire mold manufacturing base with annual yield of various tire molds 20,000 sets, and has established business relationship with 62 companies among the top 75 global tire manufacturers. Himile is the superior supplier of three worldwide top tire companies Michelin, Bridgestone and Goodyear. Its international market occupancy of tire mold is above 25%, and tire mold export amount occupied 80% in the similar products of domestic. Himile has introduced 3d printers such as Bright Laser to do the R&D for tire mould.



中国空间技术研究院总体部根据三维点阵的胞元形式的特点，结合三维点阵在航天器结构中应用的实际情况，提出三维点阵结构胞元的表达规范，即通过胞元占据的空间并结合胞元杆件的直径来表达三维点阵结构胞元的设计信息。

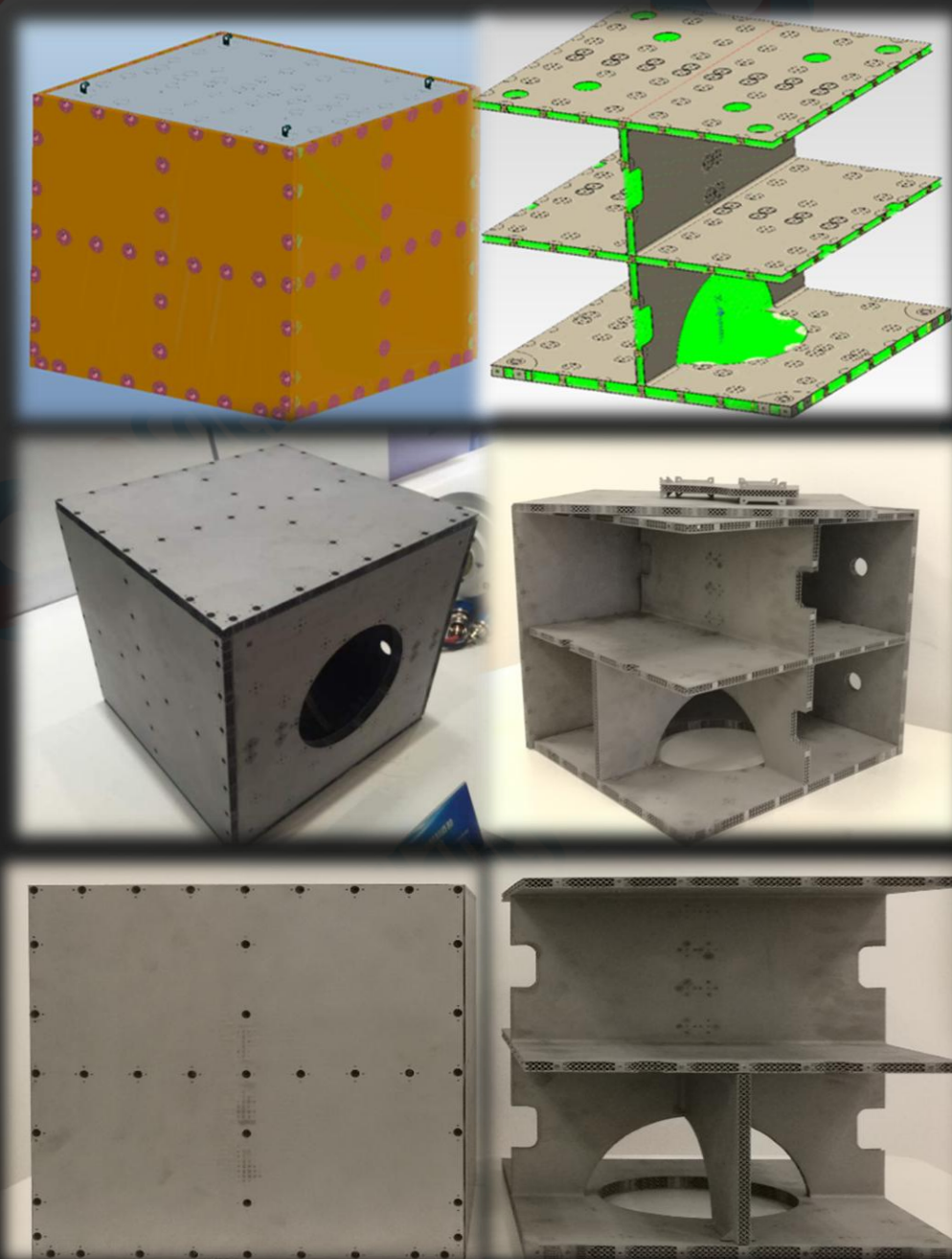
The China Academy of Space Technology has gained many years of experience in 3D printing, especially regarding design for additive manufacturing (DfAM). The academy has developed a systematic approach for the study of lattice cell structures for lightweight satellite components, and with this has achieved to be internationally competitive in this field.



中国航天

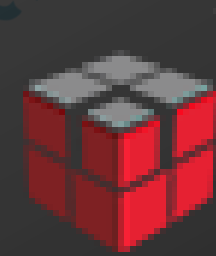
中国空间技术研究院

China Academy of Space Technology



摩方材料将微纳3D打印这一技术带到了新的高度，打印设备的精度能达微米/纳米级别，并且有能力进行大产量制造。摩方的精密3D打印技术能制造小型机械部件，如微型弹簧、特殊形状的电子接插件，甚至能制造心血管支架这样极为复杂、要求极高的医疗器件。

BMF Material Technology is a Boston/Shenzhen-based startup firm that manufactures nano or micro 3D printers and materials, as well as custom products for other companies using its equipment. Their printers have the capacity to perform high-volume manufacturing. What sets BMF apart, according to MIT technology review, is the equipment's level of rigor and the exceptional choice of materials and processes. BMF can produce small mechanical and highly complicated parts with examples ranging from tiny springs to cardiac stents.



TM

摩方材料

www.bmftec.cn

44 助听器国内典型企业 Typical Company in 3d printing hearing aids industry

在定制式助听器制作中，丽声融合西方先进技术与东方完美工艺的两方面强项，其中以生产耳内、耳道、隐形深耳道定制式助听器最为专业。

丽声助听器工厂引进德国Smart Optics扫描与德国rapidshape 3D打印系统，成为中国第一家引入3D打印系统的民族企业。

In customized hearing aid production, Lisound combines the best of Western advanced technology with the oriental strength of craftsmanship, Lisound is specialized in the customized hearing aids for ear, ear canal and invisible deep ear canal.

Lisound hearing aids factory has equipped with Smart Optics scanning and Rapidshape 3D printing system, and has become the first company who introduced 3D printing system.



www.lisound.com.cn



Equipment
Material

Process

六十余年来，上海建工多次刷新中国乃至世界工程建设史上的纪录。在积极参与中国城市化进程中，为各地奉献了众多工程精品，包括超高层建筑、大型桥梁工程、轨道交通工程、宾馆商贸楼宇工程、公共文化体育工程、工业工程、环保工程等。同时，在全球30多个国家和地区，承担了近百项工程。

Shanghai Construction Group (SCG), which has been undertaking many important tasks in the building and modernization of China's cities, is the flagship of China's building industry. SCG possesses core technologies in the construction of highrise buildings, large bridges, light railways, public culture & sport facilities, large industrial plants, major environment protection projects & etc. At the same time, SCG has also completed about 100 landmark projects in more than 30 overseas countries and regions.



46 研发 | 举例
R&D | Sample



南京航空航天大学
Nanjing University of
Aeronautics & Astronautics

仿真、特种合金

南京航空航天大学在3D打印应用研究方面处于前沿地位，不仅研究粉末床加工过程中熔池的仿真计算方法，还研究通过颗粒增强的方式提升3D打印材料的机械性能。

Simulation methods & special alloys

Nanjing University of Aeronautics and Astronautics is at the forefront in academic research of numerical simulation methods for active tracking of the solidification behavior of the laser 3D printing melting pool, for the laser-powder and particle-optical coupling process as well as laser 3D printing composite material such as special alloys and composites.

R&D-Algorithm and Simulation

- Numerical simulation of solidification behavior of laser 3D welding pool based on time and space active tracking
- The simulation method of phase and interfacial mass and heat transfer enhancement of composite materials in molten pool of laser 3D printing
- Simulation method of laser beam and powder particle solid coupling process.

R&D-Materials

- Nano scale SiC reinforced aluminum based composites
- Toughened tungsten matrix composites by laser rapid forming
- Synergistic reinforcement of Ni based composites by 3D printing
- Direct martensitic steel obtained by laser 3D printing technology

47

传统制造业正在靠近3D打印 | 举例

Traditional manufactures going to adopt 3d printing | Sample

正在考虑引入的3D打印设备

3D Printing Systems Interested

- 光聚合 resin curing
- 金属打印 metal 3d printing
铝镁合金, 钛合金 (Aluminum-magnesium alloy, titanium alloy)

考虑引入设备台数: 5-10台

Considered systems: 5 to 10 units

应用:

Application of 3d printing:

- 设计与原型制造
prototype
- 零部件生产
Components production
- 零部件修复
Refurbishment

越来越多的传统制造企业正在考虑引入3D打印技术, 例如:
More and more traditional manufacturers are considering the introduction of 3D printing technology, for example:



贵州航天天马机电科技有限公司

GUIZHOU AEROSPACE TIANMA ELECTROMECHANICAL S&T CO., LTD





其他
Other Issue

48 3D打印设备一览

国家	品牌	主要技术
中国	铂力特	粉末床熔化-PBF,直接能量沉积-DED
中国	隆源	粉末床熔化-PBF,直接能量沉积-DED
中国	永年激光	粉末床熔化-PBF,直接能量沉积-DED
中国	易加三维	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF
中国	华曙高科	粉末床熔化-PBF, 选择性激光烧结-SLS
中国	恒通	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF
中国	华科三维	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF, 选择性激光烧结-SLS
中国	联泰科技	光固化工艺- VAT Photopolymerization
中国	太尔时代	材料挤出工艺- Material extrusion
中国	盈普光电	选择性激光烧结-SLS
中国	武汉滨湖	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF, 选择性激光烧结-SLS, LOM层压技术
中国	中瑞科技	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF、选择性激光烧结-SLS
中国	先临三维	材料挤出工艺- Material extrusion, 生物打印
中国	闪铸科技	材料挤出工艺- Material extrusion
中国	武汉天昱	直接能量沉积-DED
中国	恒利	粘结剂喷射-binder jetting, 粉末床熔化-PBF, 选择性激光烧结-SLS
中国	珠海西通	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF
中国	智熔系统	粉末床熔化-PBF, 直接能量沉积-DED
中国	中科煜宸	粉末床熔化-PBF, 直接能量沉积-DED
中国	鑫精合	粉末床熔化-PBF, 直接能量沉积-DED
中国	汉邦科技	粉末床熔化-PBF
中国	广东信达雅	粉末床熔化-PBF
中国	大族激光	光固化工艺- VAT Photopolymerization, 粉末床熔化-PBF, 粘结剂喷射-binder jetting

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