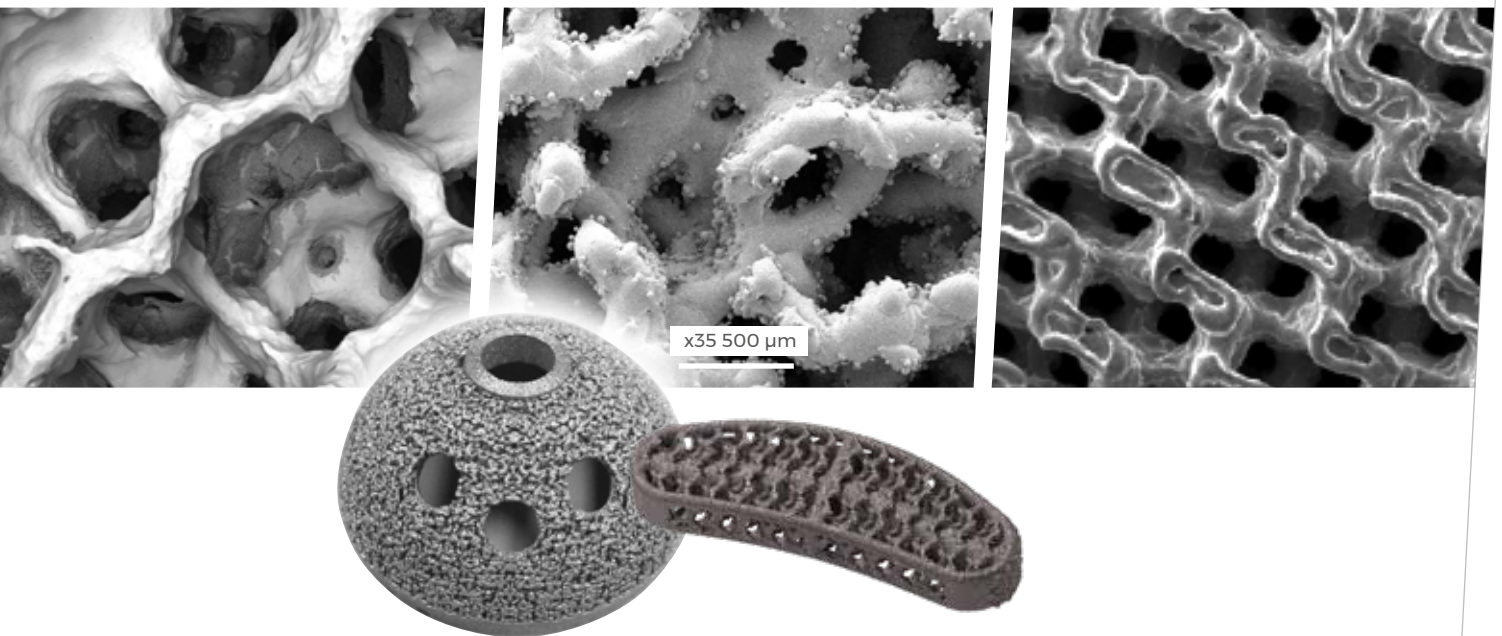


## 增材制造

医疗植入物  
多年专业制造知识和经验积累



采用最具吸引力的两种增材制造工艺：电子束  
熔融(EBM) 和直接金属粉末激光烧结(DMLS)

## 最大的设计自由度

具备复杂几何结构和形状的植入物成为设计者和终端用户非常有价值的替代方案。设计充分考虑表面多孔网络细节。植入物的弹性模量可以借助特定的多孔结构工程量身定制。



## 一站式制造

多孔结构与植入物固体部分一起构建。根据客户要求,交付的产品可以是即用型植入物,或者进行进一步的精加工,例如:加工后处理,研磨等。



## 加速研发

在研发阶段,增材制造技术可以进行产品测试,并进行批量生产成本的评估。设计更改可以简单地通过重新设计CAD文件来实现。



## 最大的制造灵活度

一旦设计最终确认,即可开始制造植入物产品。从定制到小批量,甚至批量生产:应用增材制造技术,一系列的产品可以在短短几个工作日内准备好。



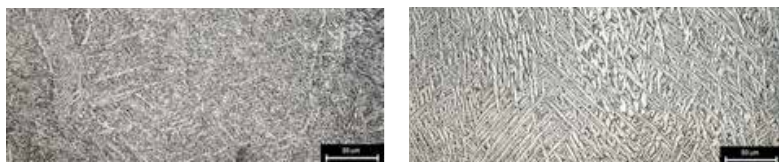
## 实际生产

增材制造技术目前既可以用于制造标准医疗植入物,又能制造用于临床的定制医疗植入物。



# 总体物料属性

使用可植入级钛及钛合金(Ti6Al4V)。化学和机械性能符合ISO和ASTM标准。总体物料的机械性能与标准制造工艺(即锻造和铸造)的机械性能相当。

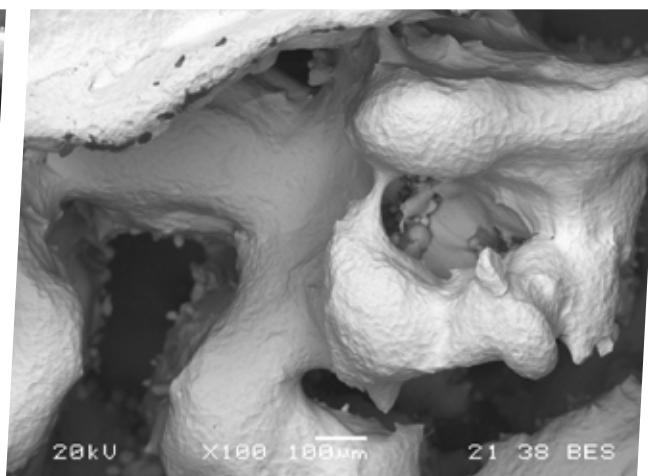
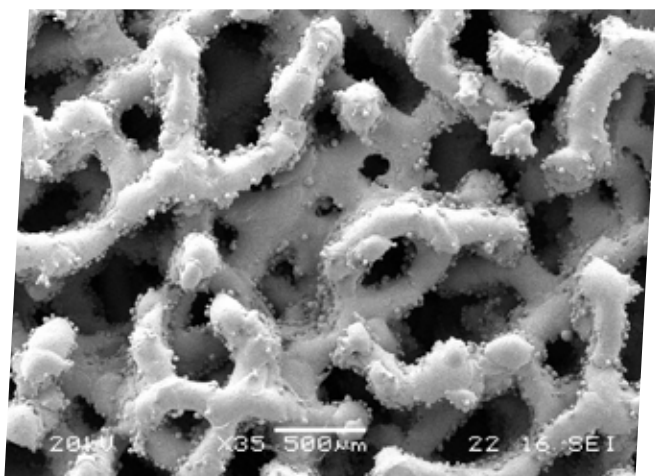


	Ti6Al4V 电子束熔融	Ti6Al4V 激光	ASTM F136
E (兆帕)	118 ± 5	111 ± 1	N.Ap. (104 ± 2*)
极限抗拉强度 (兆帕)	914 ± 10	1073 ± 4	> 860
ΔL (%)	13,1 ± 0,4	12,0 ± 0,2	> 10
2*10 <sup>6</sup> 个周期时的交变弯曲应力疲劳极限 (兆帕)	441 ± 42	440 ± 53	N.Ap. (445 ± 7*)

\*参考:锻造和退火的棒材试样

# 产品与多孔结构设计

从具有复杂几何结构的产品到晶格结构,并具有根据要求设计的特定孔隙率。或者,也可以选择我们经FDA及CE认证的多孔结构。



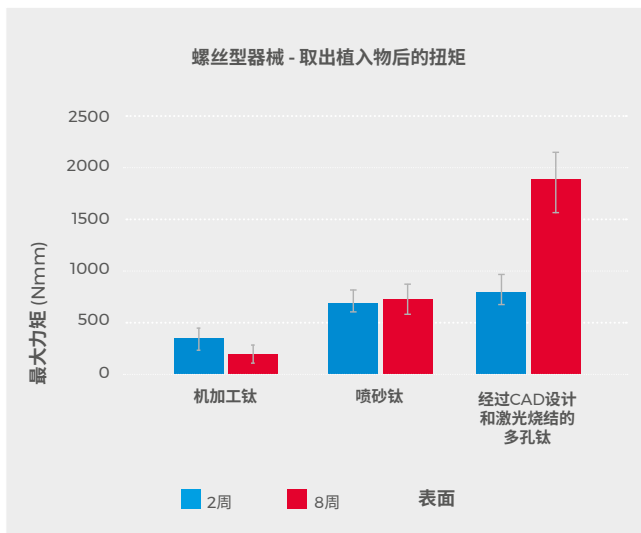
# 生物多孔结构特征

对于正确设计和制造的多孔结构, 体内测试显示:

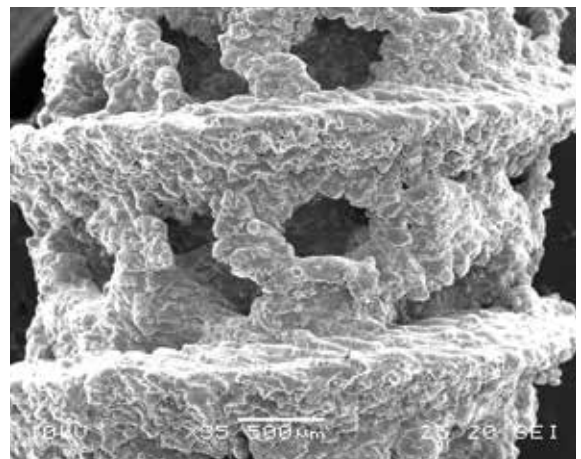
- 骨长入至增材制造晶格结构
- 植入物附近的健康骨骼
- 植入物固定强度改善

## 钛合金激光烧结样品在绵羊骨盆的植入研究

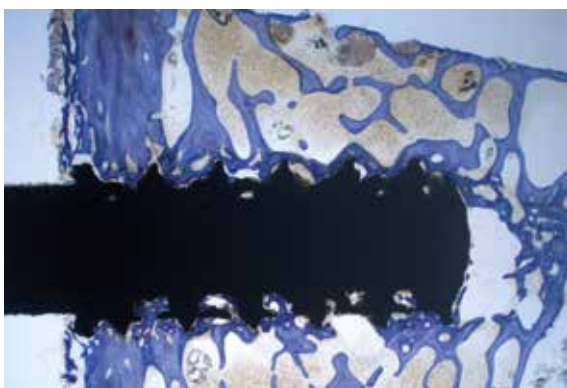
植入8周后固定强度显著增加



激光烧结钛多孔结构  
扫描电镜照片

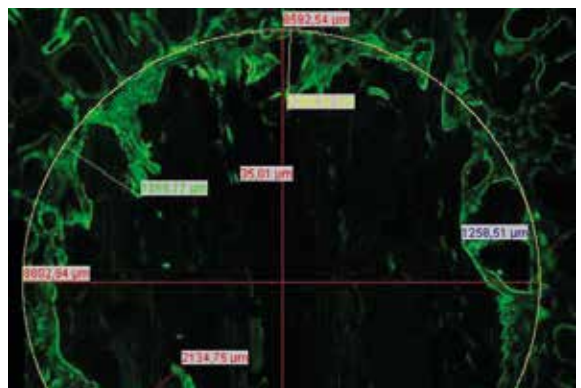


### 钛合金激光烧结样品在绵阳骨盆的植入研究



植入8周后  
组织学评价显示新骨长入激光烧结的钛多孔结构

### 钛合金电子束熔融样品在绵羊髌突的植入研究

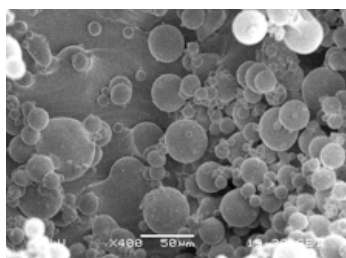
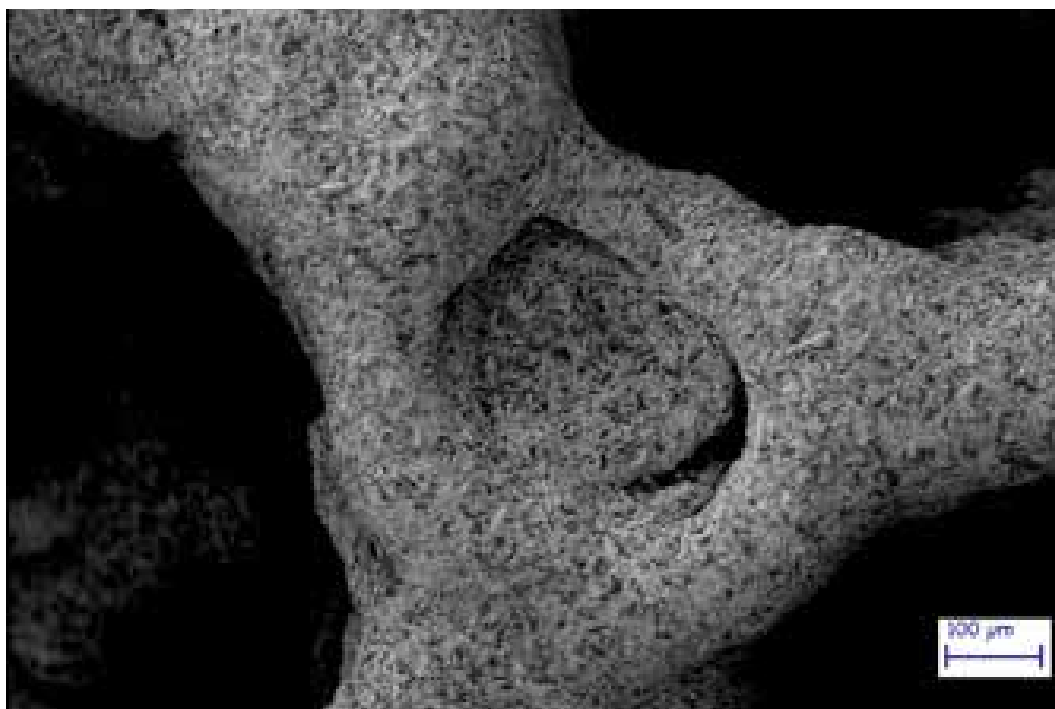


植入6周后  
荧光照片: 白色为环状手术切口; 黑色为多孔钛; 绿色为新骨长入多孔钛结构

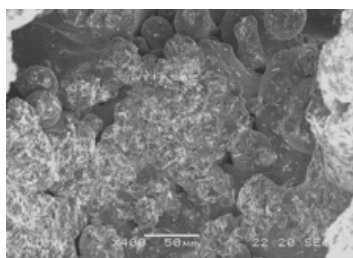
# 增材制造配套服务

## 清洗

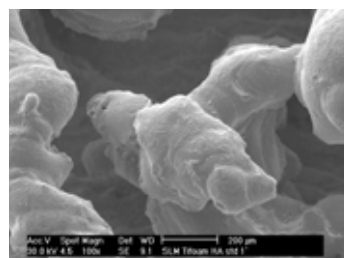
后处理工艺可进一步应用于制造的三维金属网络，以修改支柱的固有表面。在多孔结构中，额外的处理工艺可以改变孔内金属表面的形貌。



增材制造表面



喷砂后的增材制造表面



蚀刻后的增材制造表面

## 后处理



真空热处理



机加工



抛光

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