

Presentazione attività

Settore scientifico disciplinare ING-IND/16 Tecnologie e sistemi di lavorazione

Roma 27.02.2017



SAPIENZA
UNIVERSITÀ DI ROMA

DIPARTIMENTO DI INGEGNERIA
MECCANICA E AEROSPAZIALE

Barrel finishing

Drilling

Milling

Turning

Squeeze casting

Foam fabrication & characterization

Powder characterization

Additive Manufacturing

Digital Image Processing

CNC manufacturing

Mechanosynthesis

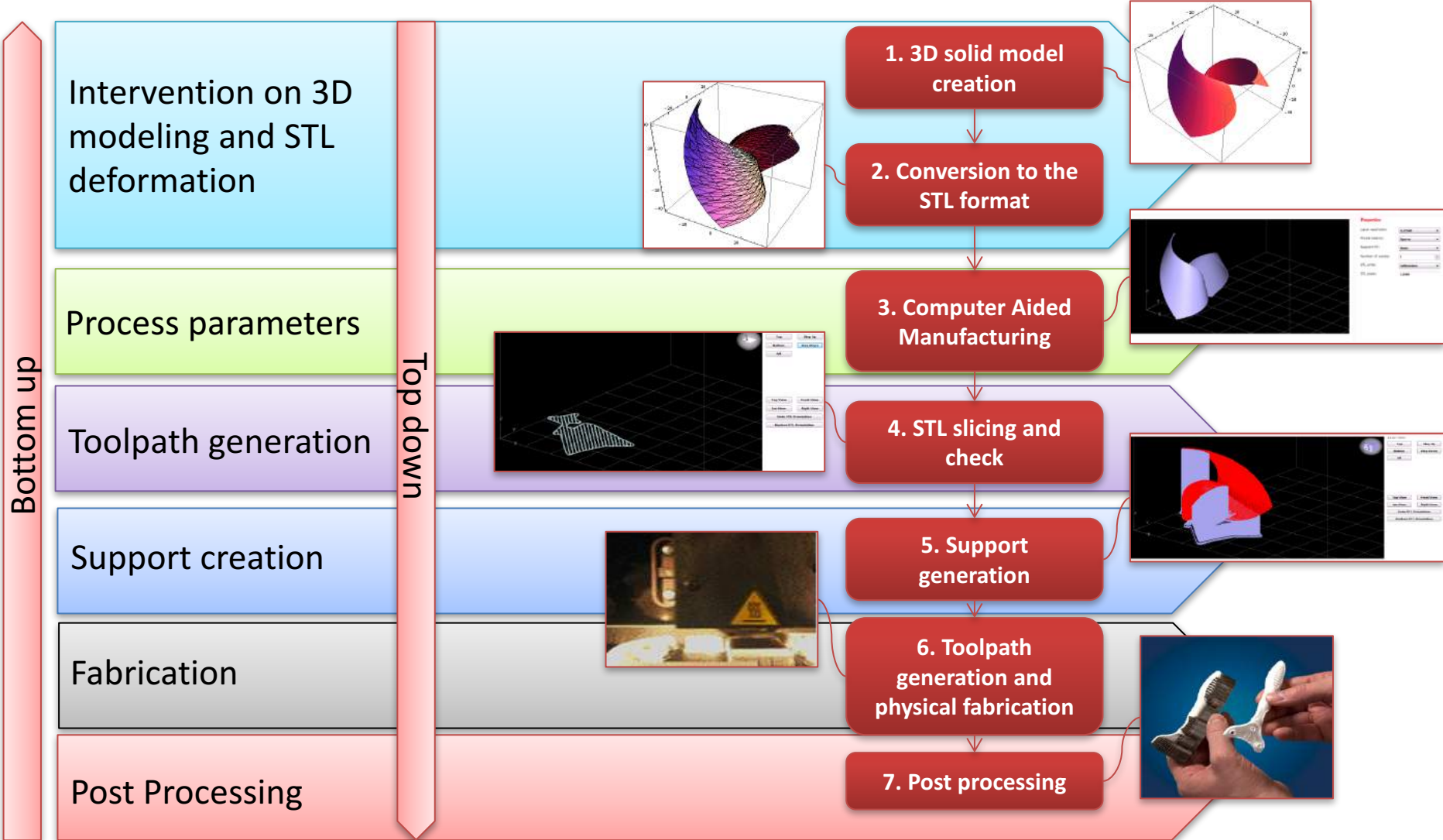
Roughness analysis

Ferrofluid fabrication

Citology

Pavement characterization

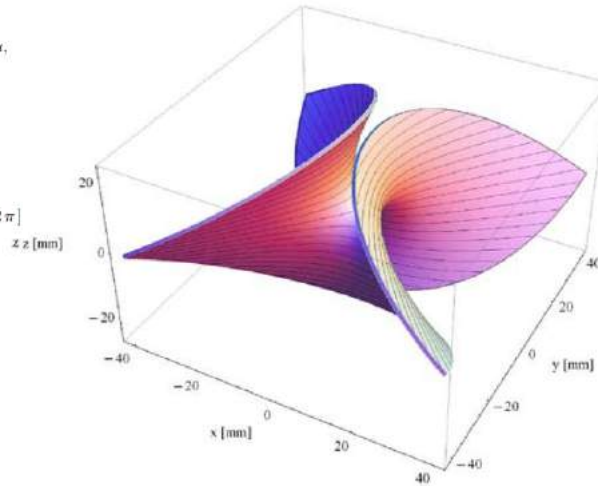
Additive Manufacturing



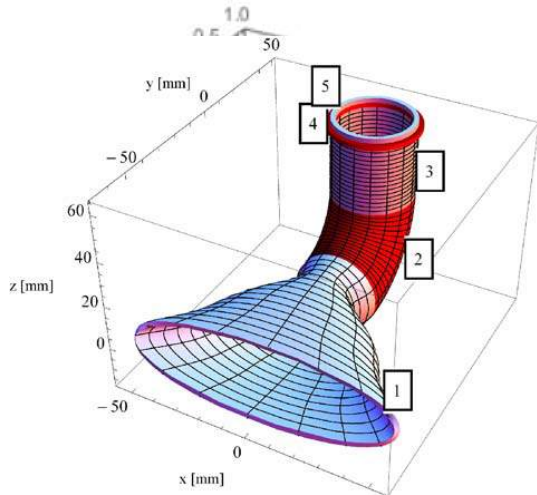
Additive Manufacturing

High complex 3D object from its mathematical formulation

- 1: $x = 30\sqrt{1 + 3u^2 - \sin^2 3u} \frac{\cos v}{2}$, $y = 30u + 4(\sin v)u$,
 $z = 30\left(\left(\frac{u^2}{10} - 1\right)\sqrt{1 - \frac{\sin^2 3u}{50}}\right) \frac{\sin v}{2}$,
 $u \in [-2, 0], v \in [0, 2\pi]$
- 2: $x = 30\frac{\sin v}{2}$, $y = 30\cos u\left(1 + \frac{\cos v}{2}\right)$,
 $z = 30\left(1 + \left(1 + \frac{\cos v}{2}\right)\sin u\right)$, $u \in \left[-\frac{\pi}{2}, 0\right], v \in [0, 2\pi]$
- 3: $x = 30\frac{\sin u}{2}$, $y = 30\left(1 + \frac{\cos u}{2}\right)$, $z = 30\left(\frac{v}{2} + 1\right)$,
 $u \in [0, 2\pi], v \in [0, 2]$
- 4: $x = 30\frac{\sin u}{2}$, $y = 30\left(1 + \frac{\cos u}{2}\right)$, $z = 2\left(\frac{v}{2} + 30\right)$,
 $u \in [0, 2\pi], v \in [0, 2]$
- 5: $x = 30\frac{\sin u}{2}$, $y = 30\left(1 + \frac{\cos u}{2}\right)$, $z = 2\left(\frac{v}{2} + 31\right)$,
 $u \in [0, 2\pi], v \in [0, 2]$

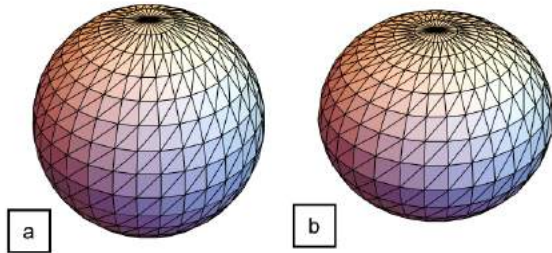


(b)

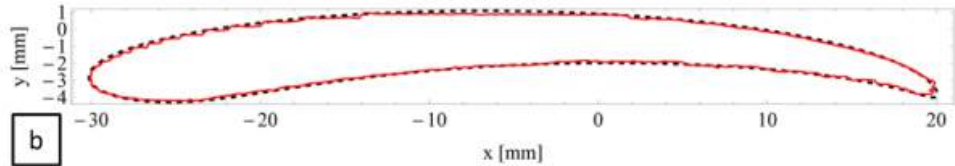
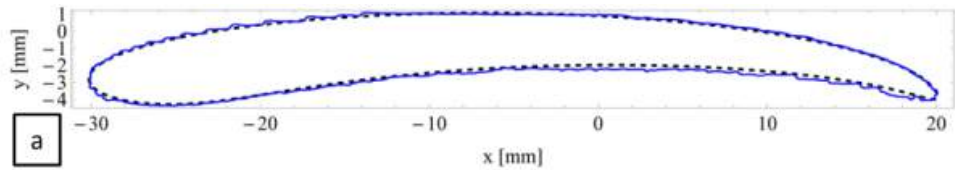
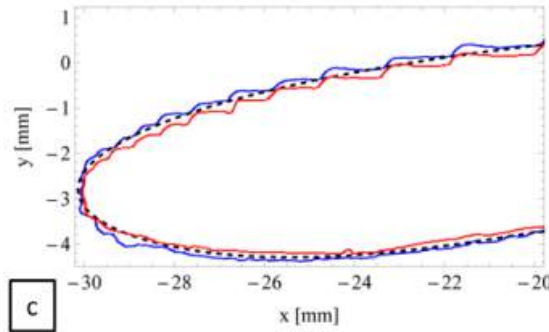
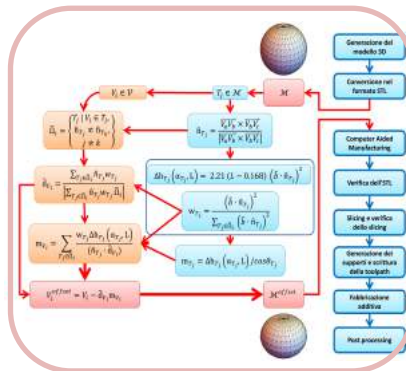
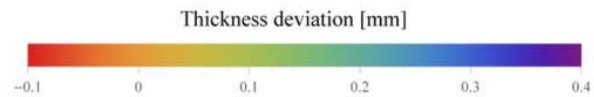
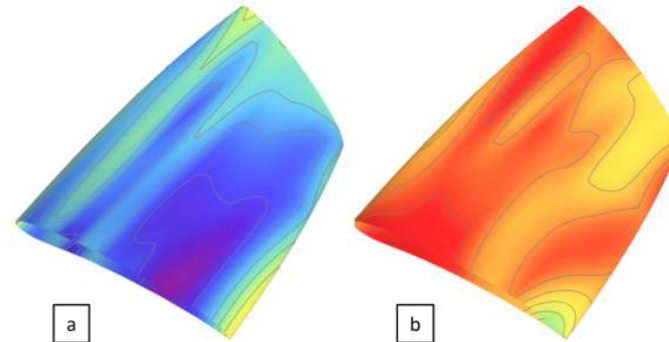


Additive Manufacturing

Non constant radius offset



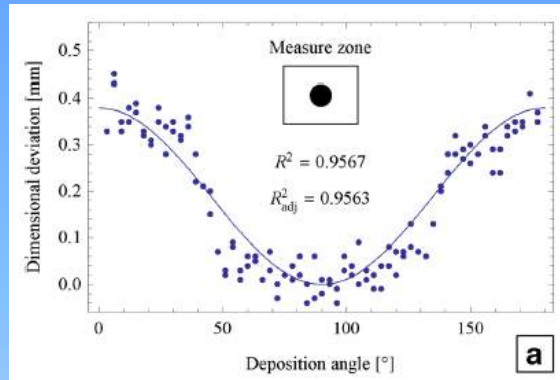
Design 4 Manufacturing



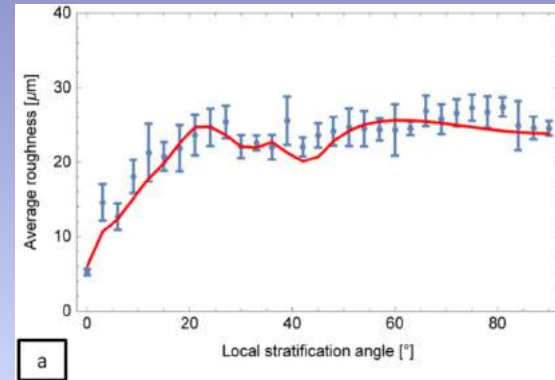
Additive Manufacturing

Prediction models of attainable surface quality

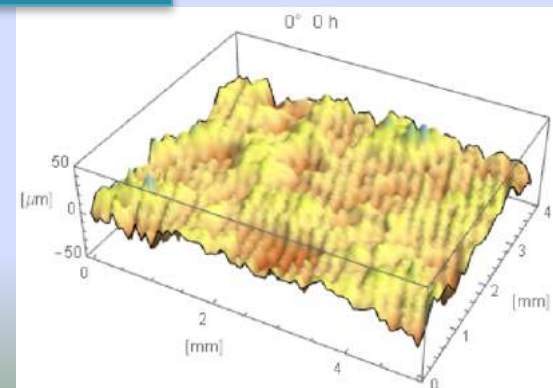
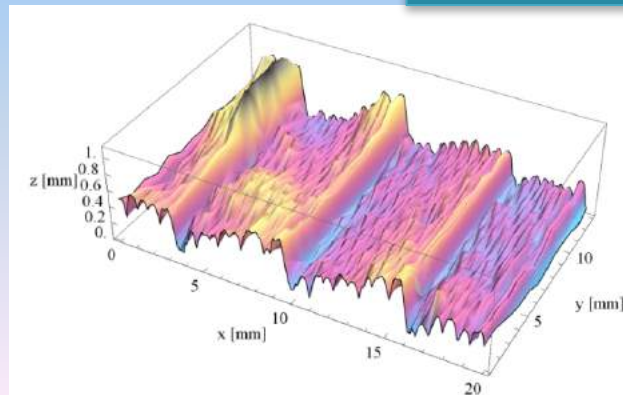
Fused Deposition Modeling



Selective Laser Melting



Micro geometry measurements



Additive Manufacturing

Integrated tool for product-process development

Progettazione del profilo

Digit 12 1

Digit 34 12

def_a 0

def_b 0.01

def_c 0.01

Corda 150

Sweep 1

Lunghezza 40

N profilo 80

N coda 100

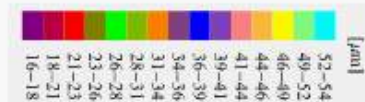
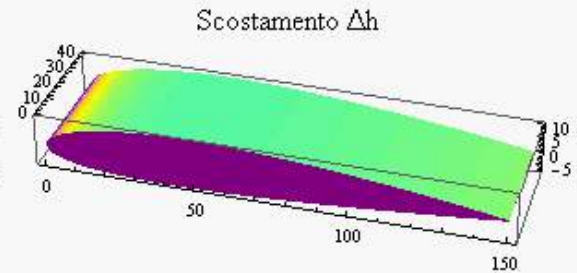
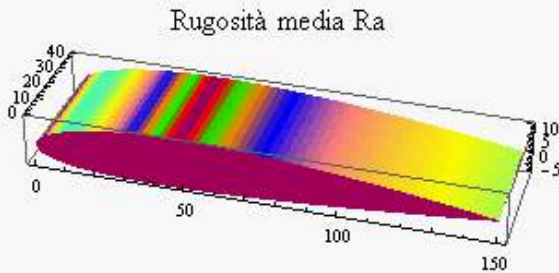
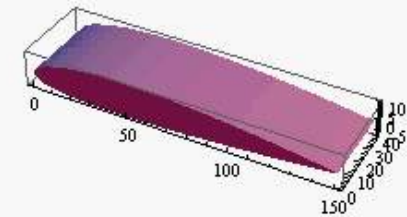
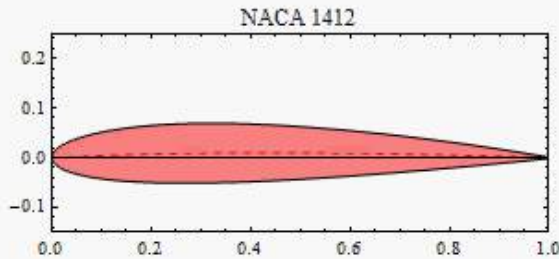
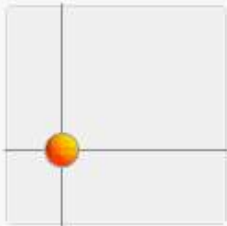
Salva modello STL

Parametri di fabbricazione

Layer

φ_x 0

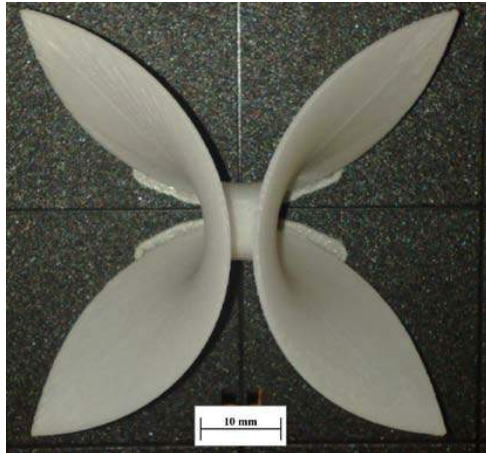
φ_y 0



Additive Manufacturing

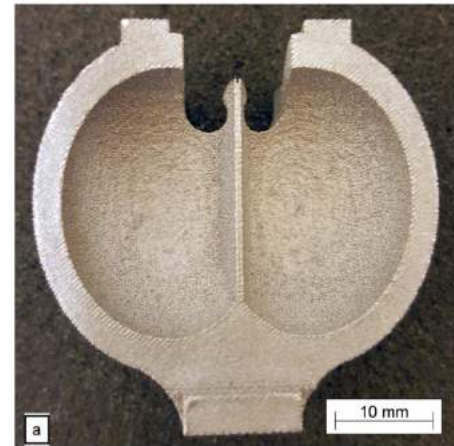
Reverse Engineering of manufactured components

FDM

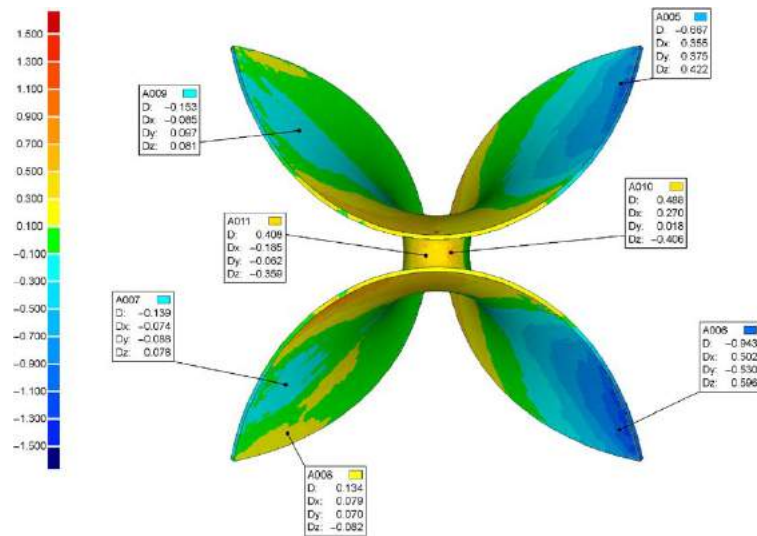


ABS

SLM

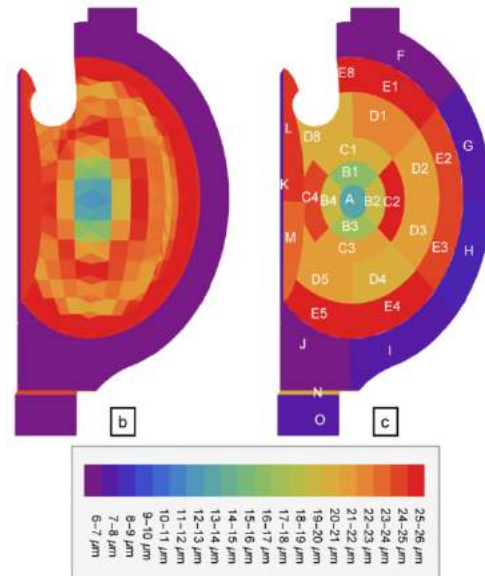


AlSi10Mg



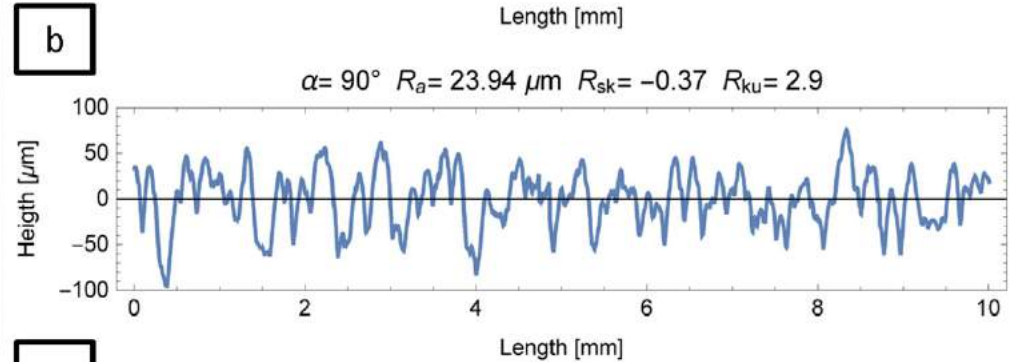
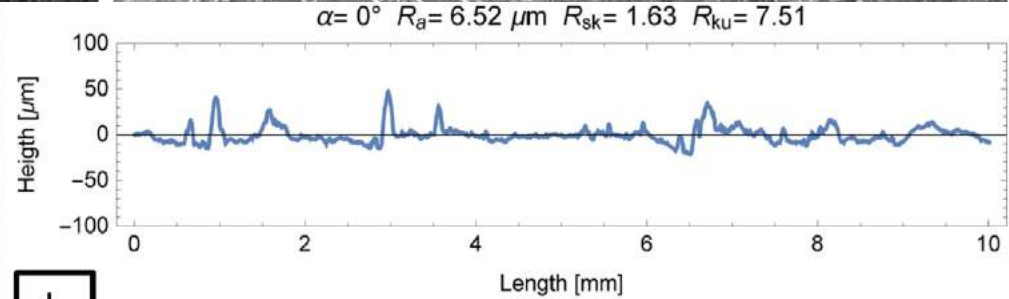
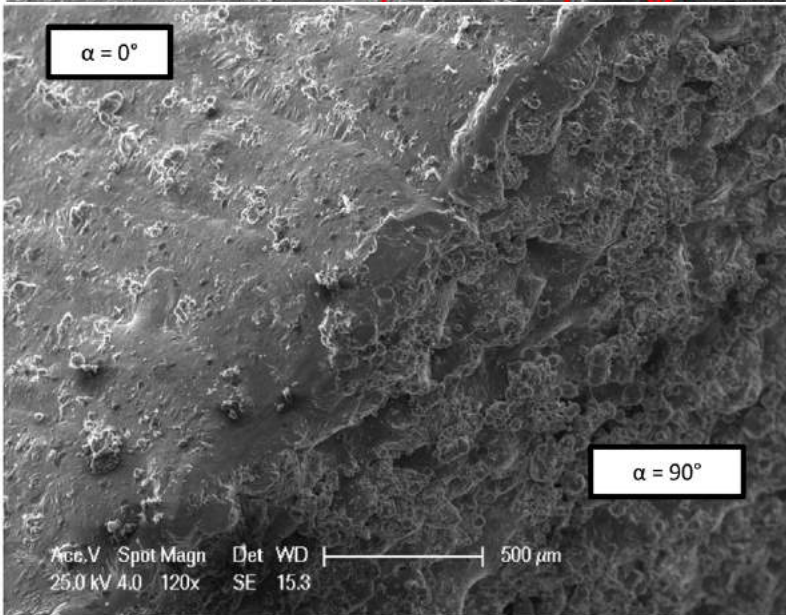
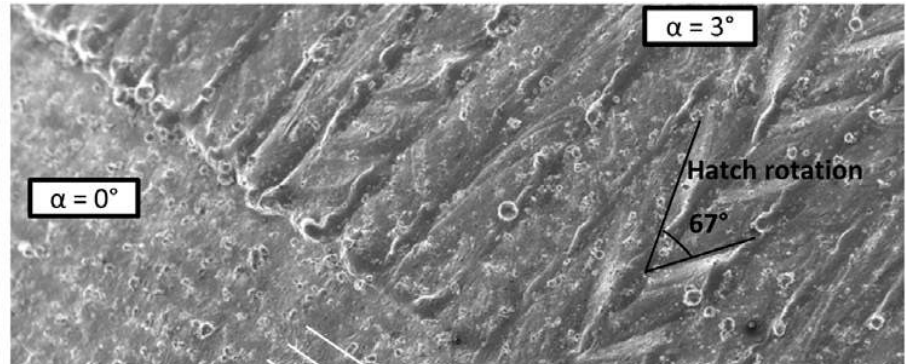
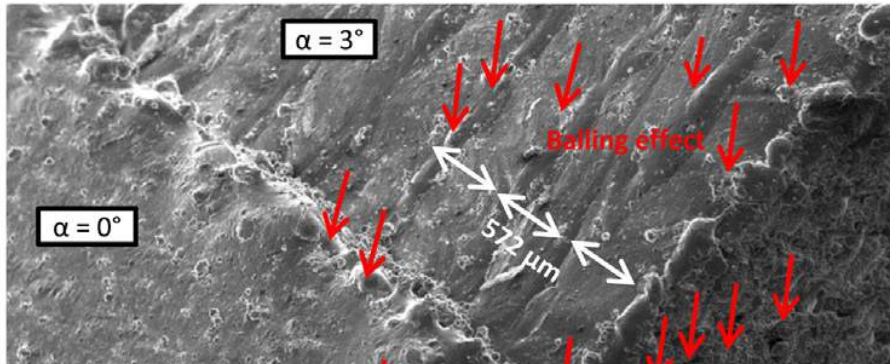
Modeled R_a

Experimental R_a



Additive Manufacturing

Microgeometrical analysis



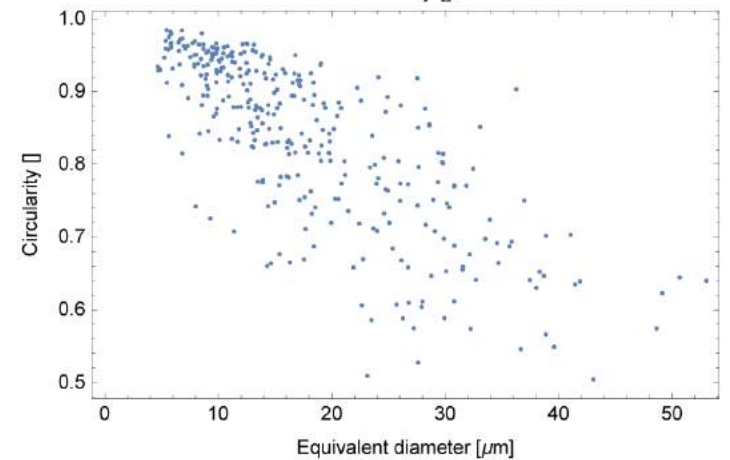
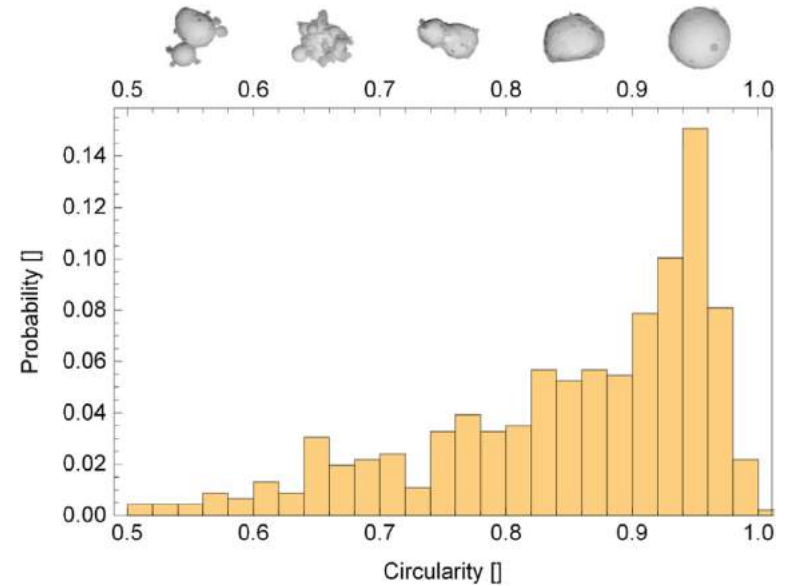
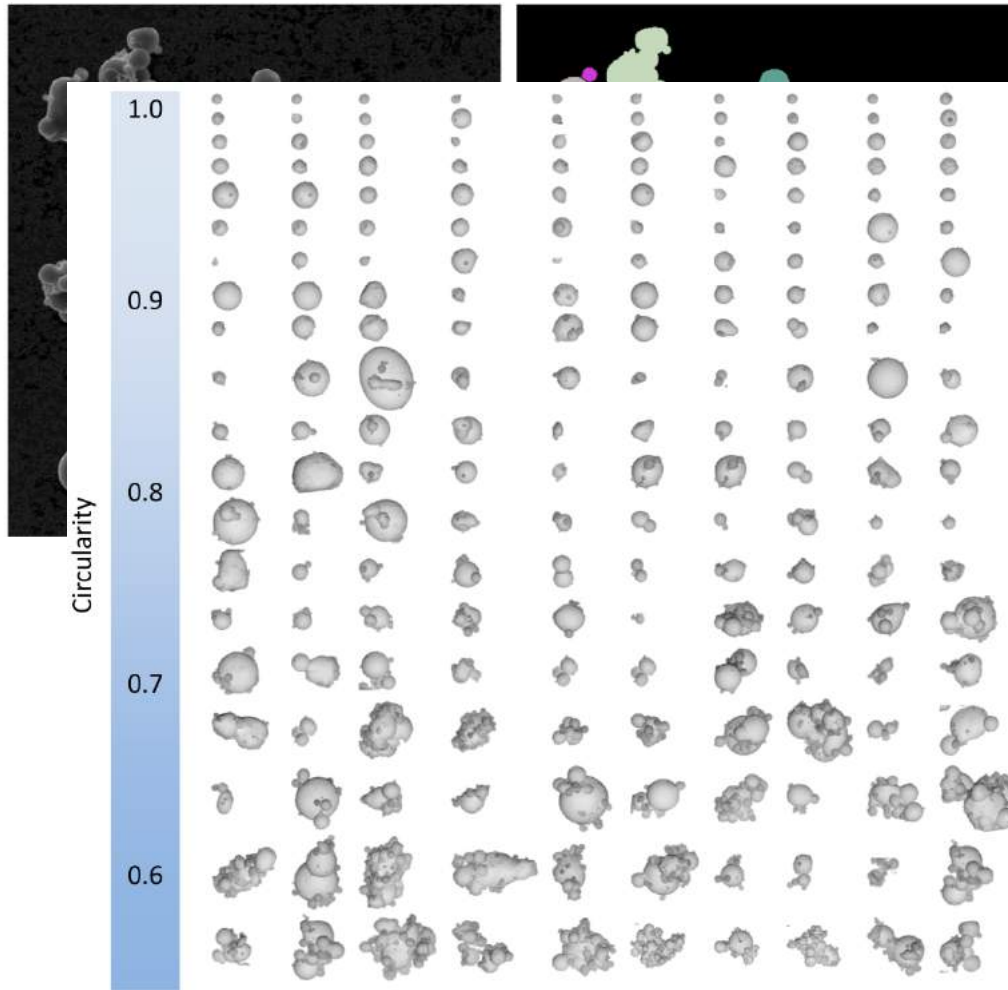
a

b



Additive Manufacturing

Morphological and morphometric analysis of powders

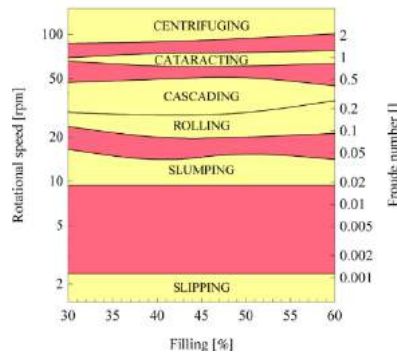
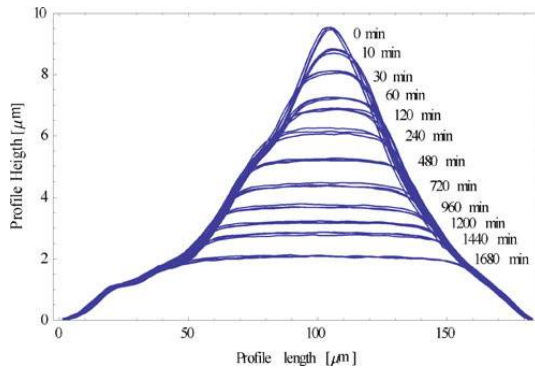


Mass finishing

Almost every material and shape can be processed

A complete analysis can be undertaken to know which process parameters are needed for traditional and unusual aims: deburring, roughing, finishing, lustering, stress inducing, stress relieving

Scientific approach: barrel finishing micromechanics



Experimental design

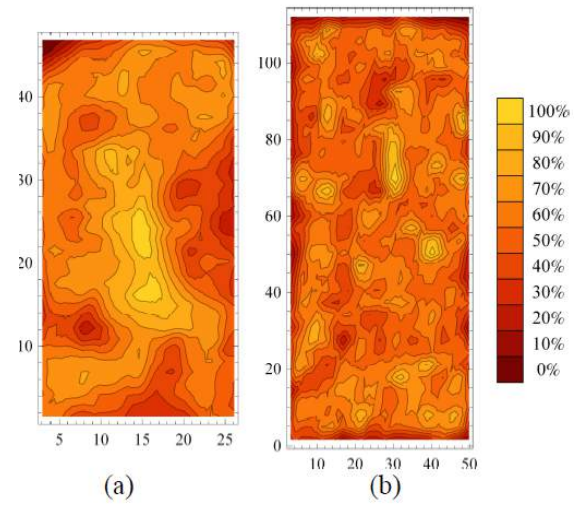
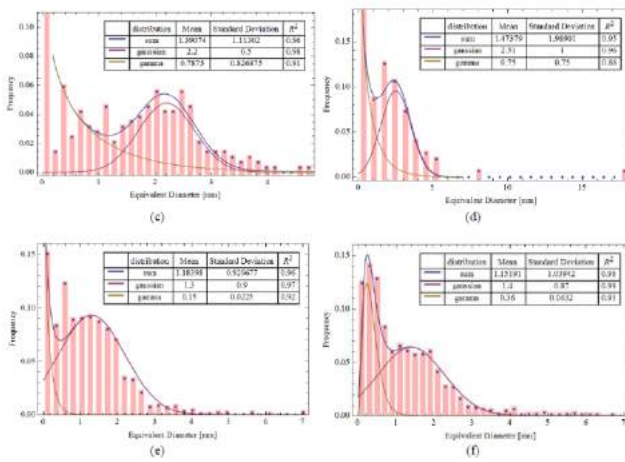
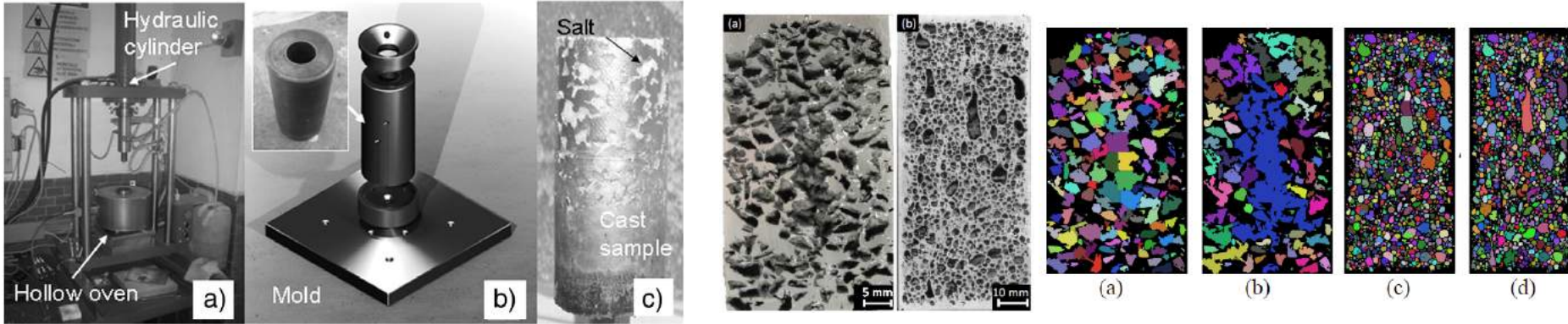


Now dedicated to AM parts conditioning

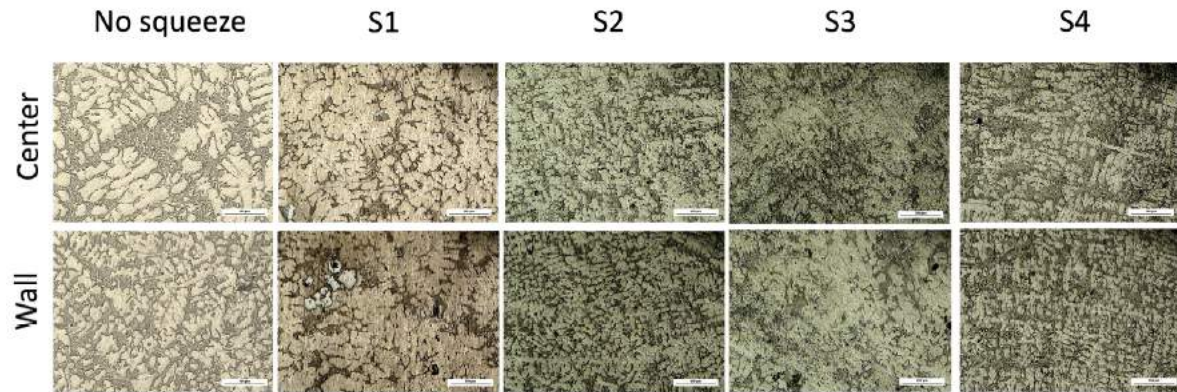
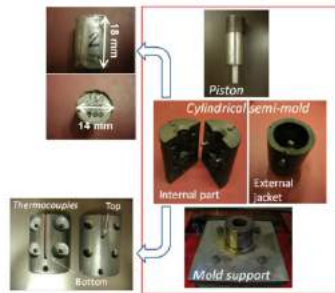


Foam fabrication and characterization

Replication casting

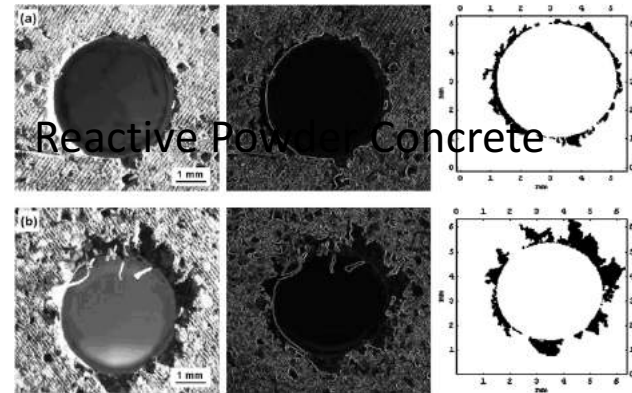
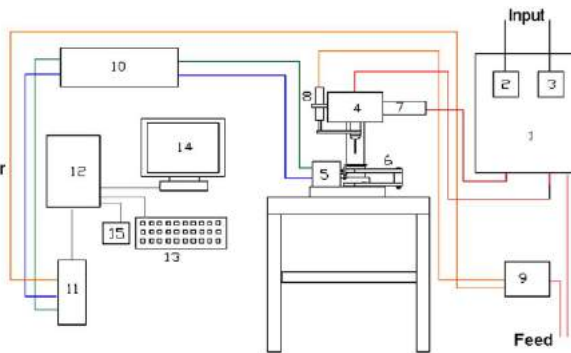


Squeeze casting

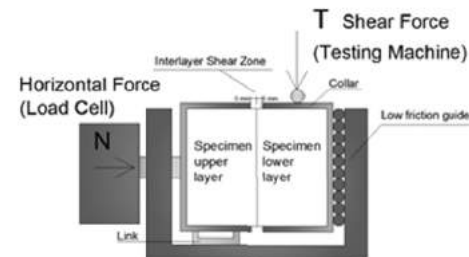
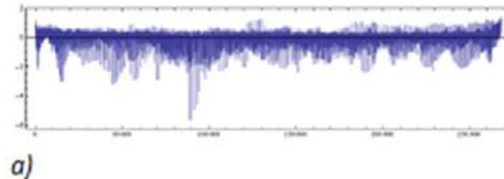
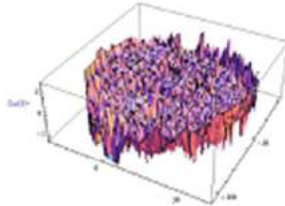
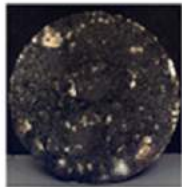


Drilling

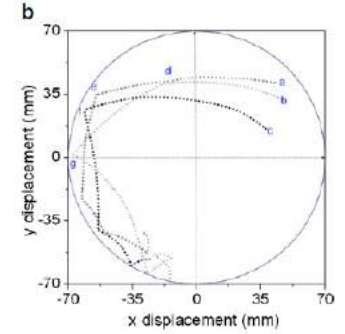
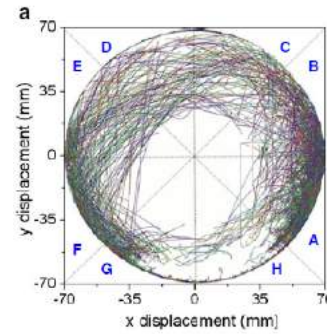
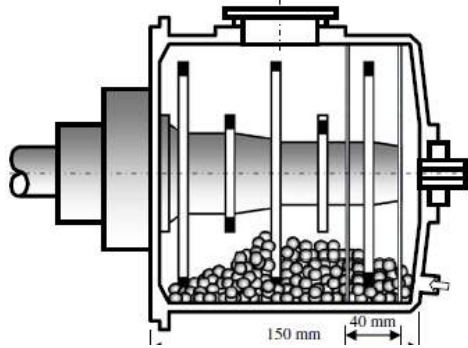
- 1) Control Panels
- 2) Feed Rate Control System
- 3) Inverter
- 4) Instrumented Drill
- 5) Load Cell
- 6) Holder
- 7) Mandrel axial movement motor
- 8) LVDT Probe
- 9) LVDT Controller
- 10) Signal Amplifier
- 11) Acquisition board
- 12-15) Personal Computer



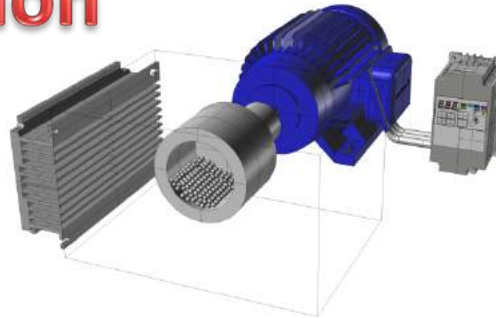
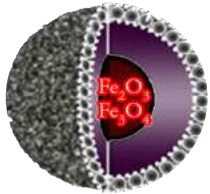
Pavement characterization



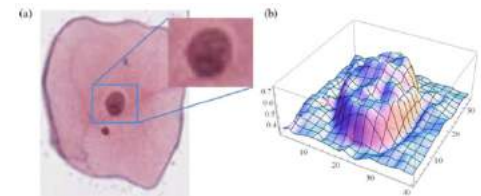
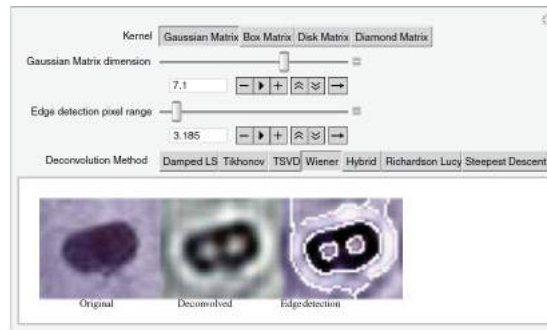
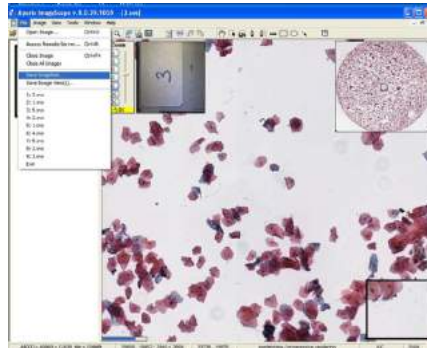
Mechanosynthesis

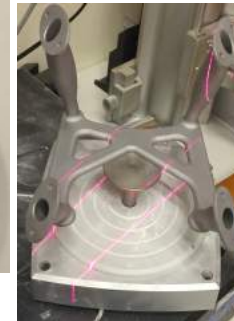
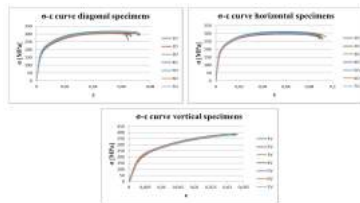
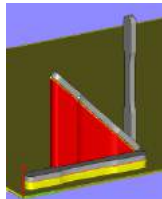
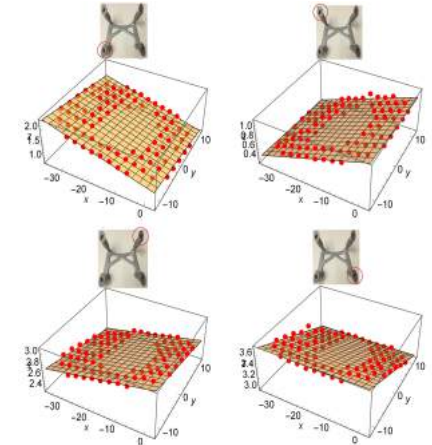
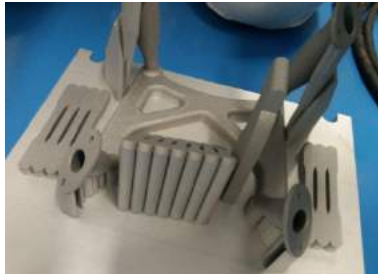
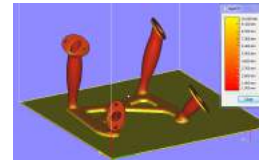
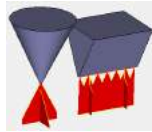
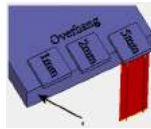
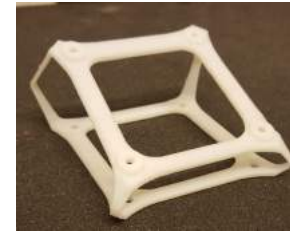
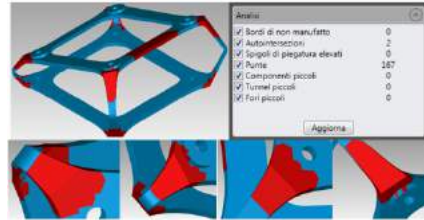


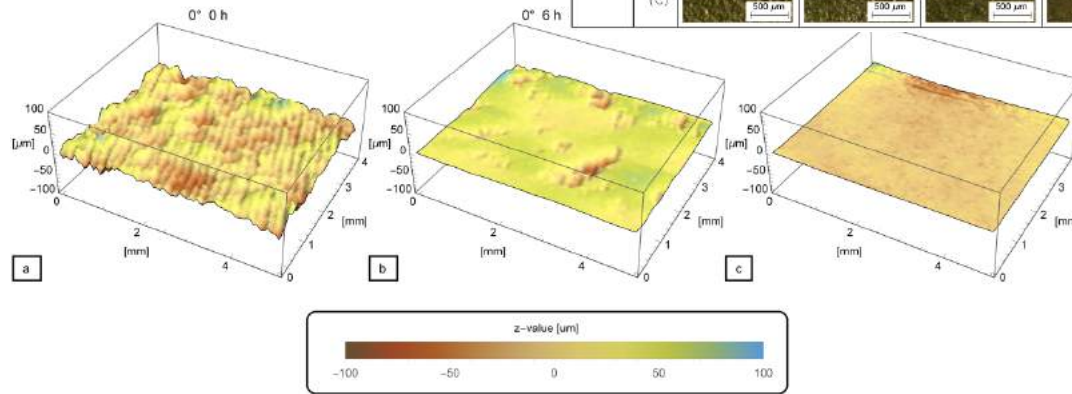
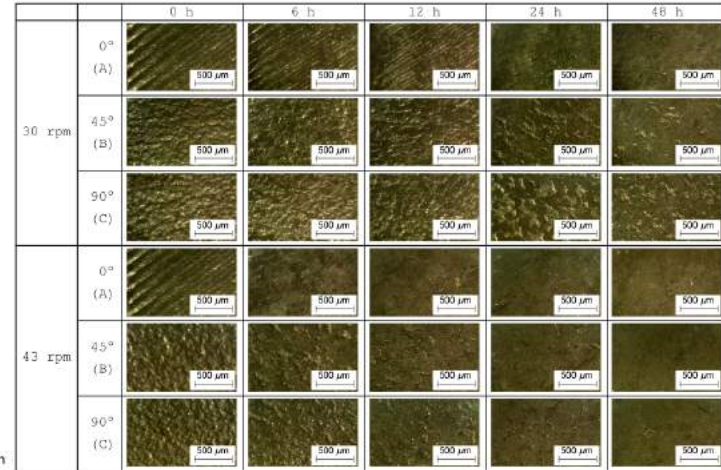
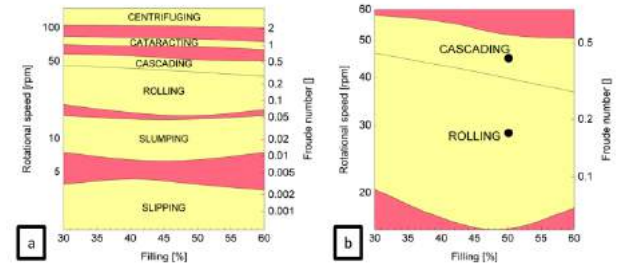
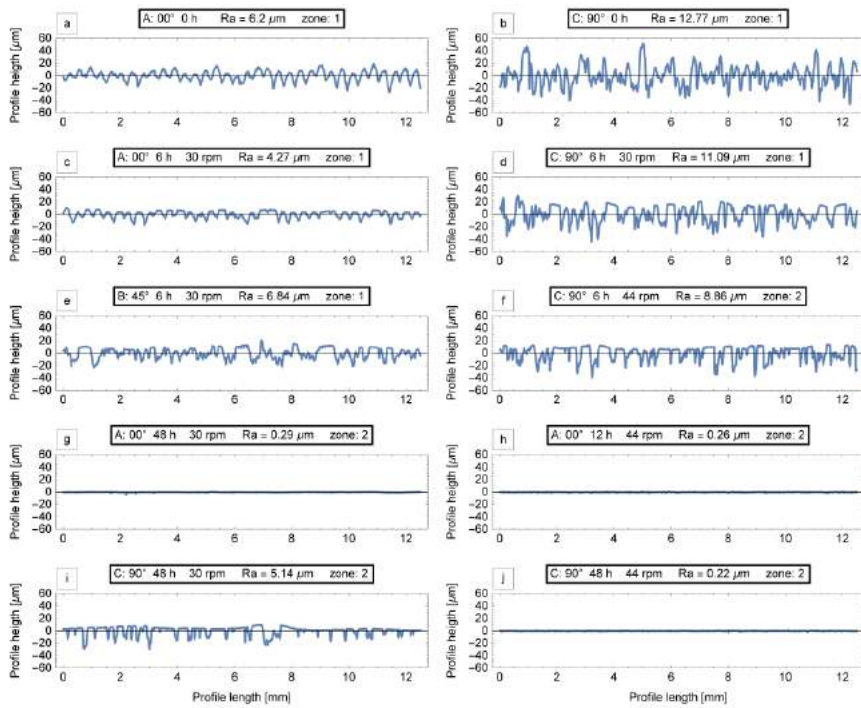
Ferrofluid fabrication



Citology







Dragonfly Srl



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