

HANSER

Andreas Gebhardt

Understanding Additive Manufacturing

Rapid Prototyping - Rapid Tooling - Rapid Manufacturing

ISBN: 978-3-446-42552-1

For further information and order see

<http://www.hanser.de/978-3-446-42552-1>

or contact your bookseller.

Index

Terms not found in the Index may occur
in the Glossary

Symbols

3D CAD 66
3D CAD data 31
3D decoration 96
3D food printer 116
3D graphs 96
3D grid 106
3-dimensional printing (3DP) 47
3D modeling 2
3D printing 2, 25, 47, 91, 116
– of foundry sands 87
3D printing process 37

A

ABS 135
active personalization 123
additive digital manufacturing (DM) 2
additive layer manufacturing (ALM) 2
additive manufacturing (AM) 2, 4, 5
– applications 73
– application sheet 1, 16
– ceramics 138
– complex geometries 104
– composites 138
– definition 1, 4
– design rules 140
– machines 58
– machines, manufacturers 130
– machines, nomenclature 25
– materials 67, 129
– metals 136
– plastics 134
– process 16, 31, 67, 116

– process selection 147
– process chain 66
– properties 147
– standardization 2
– stereolithography 16
– strategies 103
aerodynamic elements/models 97
aerosolprinting 56, 57
aerospace industry 76
AIM 15
aluminum 137
Anaplastologist 92
anisotropic properties 130, 131
application 6
application workflow 66, 67
architecture and landscaping 93
art and history of art 83
articulated cable clamp 109
automotive industries and suppliers 73

B

bionic handling system 112
biplotter 56, 117
body scanning 84
bonding 35
bores 145, 146
break out 42
bridge tooling 14
bronchial tube 105
build chamber 35
build management 147
build platform 35
build process 34

C

CAD data set 4
 car components
 – exterior 75
 – interior 73
 ceramic micro sintering machines 43
 ceramics for AM 138
 cladding 43
 clamping 143
 clearance 142
 clothes 114
 CoCr-alloys 137
 colored models 48
 composite materials 139
 composites for AM 138
 computed tomography (CT) 91
 concept modeling 7
 conformal cooling 13, 90, 105
 Connex 38
 consumer goods 78
 contour data 5
 contouring 35
 cool-down 41
 copper 137
 coproducing 118, 126
 cusing 43
 customized mass production 117, 118
 customized product 117
 cutting 33

D

data control models 8
 data formats 67
 data processing 66
 delamination 131
 dental bridge 123
 design freedom 141
 Designjet 125
 desktop manufacturing 3
 die making 89
 digital fabrication 2
 digital light processing 38
 digital mock-up 2
 digital product model 5
 digital to object 141
 direct manufacturing 2, 11

– example 12
 direct processes 7
 direct tooling 2, 11, 12
 distortion 134
 distributed customized production 118, 126
 DLP projectors 33
 drillings 145
 drop on powder processes 47

E

electron beam melting (EBM) 40
 – definition 44
 electron beams 33
 engineering design rules 140
 EOS 395 42
 epithesis 93
 epoxy resins 135
 extruders 33
 extrusion 33, 45

F

fabbers 25, 27, 58, 125
 fabricators 24, 25, 58
 fabric-type products 114
 FDM parts 47
 FDM post processing 47
 FDM processes
 – plastic materials 46
 filament 45
 film hinges 42, 108
 film joints 142
 finishing 36
 flexure hinge 111, 112, 113
 flexures 142
 food processing 116
 formative manufacturing 2
 foundry and casting technology 85
 freeform elements 97
 freeform manufacturing 3
 front end software 67
 functional prototyping 7, 8
 fused deposition modeling (FDM) 45
 – example 10
 fused layer manufacturing 91
 fused layer modeling 45
 fusing 43

G

gaps 145
 generative manufacturing 2
 geodesic data 80, 95
 graded materials 115
 green part 67

H

hearing aid shells 122
 hinges 142
 hysteresis 143

I

implant, scull 92
 indirect manufacturing
 – definition 22
 – example 22
 indirect processes 7
 – definition 17
 indirect prototyping, definition 17
 indirect rapid prototyping process 17
 indirect tooling, definition 20
 individualization 117, 119
 infrared heaters 33
 integrated functionalities 108
 integrated geometry 106
 investment casting 88
 isentropic 130
 isentropic materials 133
 isotropic material 115

J

jewelry 119, 120

K

kinematic functions 108
 knives 33

L

laminated object manufacturing (LOM),
 definition 52
 laminate manufacturing (LLM) 91
 laser 33
 laser fusing 40
 laser melting 40
 – definition 42

laser scanner 35
 laser sintering 22, 23, 88, 91
 – definition 40
 – of sand cores 87
 laser stereolithography (SL) 34, 91
 layer-based manufacturing 2
 layer-based technology, principle 3
 layer contouring 33
 layer laminate manufacturing (LLM) 54
 – definition 52
 layer manufacturing 2, 31
 layer number 5
 layer oriented manufacturing 2
 layer thickness 5
 – standard 32
 LLM machines for metal parts 55
 lost patterns 88
 lost-wax casting / process 23, 88

M

magnesium 137
 makerbot 125
 Maskles Mesoscale Materials
 Deposition (M3D) 56
 Materials
 – plastics 134
 – metals 136, 137
 – ceramics 138
 – composites 138
 MCOR matrix 54
 medical application, example 92
 medical imaging processes 91
 melting 33, 40
 melt pool 42
 meta design 124
 metal die casting 89
 metal micro sintering machines 43
 metal printing 50
 metals for AM 136
 micro stereolithography 39
 mold making 89
 monochromatic 48
 multi-material parts 115
 multi-material processing 56
 – of organic materials 116
 multi-nozzle print heads 33

O

objet 37
 office machines 25, 27, 58
 organ printing 57
 on-demand manufacturing 3
 one-offs 118
 orientation 142, 143
 ornaments 96

P

paper lamination 54
 partial denture 123
 particle bonding 33
 part 3
 part property management (PPM) 132
 part property profiles (PPPs) 132, 147
 PEEK (polyetheretherketones) 135
 perfectory 38
 personal fabrication 117, 124
 personal fabricators (PF) 125
 personalization 118, 121, 124
 – active 121
 phase changes 141
 photo-polymerization 33
 photosensitive 38
 photosensitive monomers 38
 physical layer, generation 33
 pins 145, 146
 plastic laminate printers 54
 plastics for AM 134
 plastic triangle 136
 plotters 33
 PMMA 88, 136
 polyamides 42, 134
 poly-jet matrix 38
 polymerization 34
 polymer jetting 37, 38, 91, 115
 polymer printing 37
 post-cured 36
 post-curing oven 36
 post processing 36
 powder-binder bonding 47
 powder-binder process 8
 powder cake 41
 practical approach 6
 printers 25, 58
 process chain 5
 product design 103

product development 103
 prototyper 25
 prototype tooling 12, 14
 – definition 14

R

rapid manufacturing 2, 6
 – definition 11
 – workflow 69
 rapid prototyping 1, 2, 6, 7
 – workflow 68
 rapid prototyping software 67
 rapid technology 2
 rapid tooling 2, 89
 – definition 12
 recoating 36, 41
 relative fit 141
 repair software 71
 roller 41
 roller-based systems 41
 room temperature vulcanization (RTV) 18

S

sand casting 86
 sand (foundry) printing 51
 scaled concept models 8
 skull facsimile 91
 secondary rapid prototyping process 17, 59
 selective fusing 33
 selective laser melting (SLM) 132
 – definition 42
 selective laser sintering (SLS)
 – definition 40
 – example 11
 selective mask sintering 40
 self customization 124
 shielding gas 40
 shop floor machines 25, 27, 58
 show-and-tell models 8
 silicon rubber molding 18
 single-nozzle print heads 33
 sintering 33, 40
 slicing 32
 SLM
 – machine designs 43
 – machines 43
 – metals 43
 small batch production 118

snap-fit 42, 108, 142
 snap-fit mechanism 110
 solidica 55
 solidification 35
 solid imaging 7
 solids 31
 stainless steel 137
 stair stepping 3, 32, 144
 standardization 3
 standard transformation language (STL) 70
 stereolithography 34
 – language 70
 STL
 – data structure 70
 – errors 70
 – repair 70
 STL format 67
 subtractive manufacturing 2
 support material 115
 supports 36

T

textures 96
 thermoplastic material 88
 three dimensional printing 47
 – Prometal 50
 – Voxeljet 51
 – Z-Corporation 48
 titanium 137

tolerances 140
 tool steel 137
 toy industry 82
 triangulation 71
 two-piece hinge 112

U

ultrasonic consolidation 55
 ultrasonics (US) 91
 undercuts 141
 UV chamber 36

V

Vflash, V-flash 58, 123
 vacuum casting 18
 vacuum depositing devices 36
 virtual object 5
 voxel 3, 116
 VRML format 67

W

walls 145
 wall thickness 146
 warping 134
 wax 88
 wiper-type systems 41

Z

Z-printer 48