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Factsheet: Systems, Additive Manufacturing

A technology field created by ip-search

1 Definition

Additive manufacturing is a process through which three-dimensional (3-D) solid objects are created.
It enables the creation of physical 3-D models of objects using a series of additive or layered development framework, where layers are laid down in succession to create a complete 3-D object.
First, it takes graphical data input from the computer, which is often created using a computer-aided manufacturing (CAM) tool, and cuts the data to serve separate object layers or components. The segmented/layered graphical data is sent to the 3-D printer, which applies the required combination of raw material for that particular layer. The printer then adds up the product development layer by layer until it is completely designed and finished according to the design criteria.

2 CPC / IPC

2.1 Cooperative Patent Classification (CPC) / International Patent Classification (IPC)

CPC/IPC/FI Symbols	Description
A	HUMAN NECESSITIES
A23	FOODS OR FOODSTUFFS; THEIR TREATMENT, NOT COVERED BY OTHER CLASSES
A23G	COCOA; COCOA PRODUCTS, e.g. CHOCOLATE; SUBSTITUTES FOR COCOA OR COCOA PRODUCTS; CONFECTIONERY; CHEWING GUM; ICE-CREAM; PREPARATION THEREOF
A23G3/00	Sweetmeats; Confectionery; Marzipan; Coated or filled products (chewing gum A23G4/00)
A23G3/34	. Sweetmeats, confectionery or marzipan; Processes for the preparation thereof
A23G3/50	.. characterised by shape, structure or physical form, e.g. products with supported structure (composite structures including chocolate, e.g. as layer, coating or filler A23G1/54)
A23G3/54	... Composite products, e.g. layered, coated, filled
A23P	SHAPING OR WORKING OF FOODSTUFFS, NOT FULLY COVERED BY A SINGLE OTHER SUBCLASS
A23P20/00	Coating of foodstuffs; Coatings therefor; Making laminated, multi-layered, stuffed or hollow foodstuffs
A23P20/20	. Making of laminated, multi-layered, stuffed or hollow foodstuffs, e.g. by wrapping in preformed edible dough sheets or in edible food containers
A23P20/25	.. Filling or stuffing cored food pieces, e.g. combined with coring or making cavities
A23P2020/253	... {Coating food items by printing onto them; Printing layers of food products}
A61	MEDICAL OR VETERINARY SCIENCE; HYGIENE
A61C	DENTISTRY; APPARATUS OR METHODS FOR ORAL OR DENTAL HYGIENE (non-driven toothbrushes A46B; {tongue scrapers A61B17/24;} preparations for dentistry A61K6/00; preparations for cleaning the teeth or mouth A61K8/00, A61Q11/00)
A61C13/00	Dental prostheses; Making same (tooth crowns for capping teeth A61C5/70; dental implants A61C8/00)
A61C13/0003	. {Making bridge-work, inlays, implants or the like}
A61C13/0006	.. {Production methods}
A61C13/0013	... {using stereolithographic techniques}
A61C13/0018	... {using laser}
A61C13/0019	... {using three dimensional printing}

CPC/IPC/FI Symbols	Description
A61F	FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, e.g. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS (dental prosthetics A61C)
A61F2/00	Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, A41G3/00, A41G5/00, artificial nails A45D31/00; dental prostheses A61C13/00; materials for prostheses A61L27/00; artificial hearts A61M1/10; artificial kidneys A61M1/14)
A61F2/02	. Prostheses implantable into the body {(closure means for urethra or rectum or for artificial body openings therefor A61F2/0004)}
A61F2/30	.. Joints
A61F2/3094	... {Designing or manufacturing processes}
A61F2/30942	.... {for designing or making customized prostheses, e.g. using templates, CT or NMR scans, finite-element analysis or CAD-CAM techniques}
A61F2002/30962	..... {using stereolithography}
A61F2002/30985	.... {using three dimensional printing [3DP]}
A61L	METHODS OR APPARATUS FOR STERILISING MATERIALS OR OBJECTS IN GENERAL; DISINFECTION, STERILISATION OR DEODORISATION OF AIR; CHEMICAL ASPECTS OF BANDAGES, DRESSINGS, ABSORBENT PADS OR SURGICAL ARTICLES; MATERIALS FOR BANDAGES, DRESSINGS, ABSORBENT PADS OR SURGICAL ARTICLES
A61L27	Materials for grafts or prostheses or for coating grafts or prostheses
A61L27/50	Materials characterised by their function or physical properties
A61L27/52	. . Hydrogels or hydrocolloids
B	PERFORMING OPERATIONS; TRANSPORTING
B22	CASTING; POWDER METALLURGY
B22F	WORKING METALLIC POWDER; MANUFACTURE OF ARTICLES FROM METALLIC POWDER; MAKING METALLIC POWDER (processes or devices for granulating materials in general B01J2/00; making ceramics by compacting or sintering C04B, e.g. C04B35/64; for the production of metals as such, see class C22; reduction or decomposition of metal compounds in general C22B; making alloys by powder metallurgy C22C; electrolytic production of metal powder C25C5/00)
B22F3/00	Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering; Apparatus specially adapted therefor {; Presses and furnaces}
B22F3/008	. {Selective deposition modelling (B22F3/1055 takes precedence)}
B22F3/10	. Sintering only
B22F3/105	.. by using electric current {other than for infra-red radiant energy}, laser radiation or plasma (B22F3/11 takes precedence){; by ultrasonic bonding (B22F3/115 takes precedence)}
B22F3/1055	... {Selective sintering, i.e. stereolithography (selective sintering of powdered plastics B29C64/153)}
B22F2003/1056	.... {Apparatus components, details or accessories}
B28	WORKING CEMENT, CLAY, OR STONE
B28B	SHAPING CLAY OR OTHER CERAMIC COMPOSITIONS, SLAG, OR MIXTURES CONTAINING CEMENTITIOUS MATERIAL, e.g. PLASTER (foundry moulding B22C; working stone or stone-like material B28D; shaping of substances in a plastic state, in general B29C; making layered products not composed wholly of these substances B32B; shaping in situ, see the relevant classes of section E)
B28B1/00	Producing shaped {prefabricated} articles from the material (using presses B28B3/00; shaping on moving conveyors B28B5/00; producing tubular articles B28B21/00 {; producing articles with embedded elements B28B23/00})
B28B1/001	. {Rapid manufacturing of 3D objects by additive depositing, agglomerating or laminating of material (selective deposition modelling of metallic powder B22F3/008; rapid manufacturing of 3D objects in general and in particular of plastics B29C64/00)}
B29	WORKING OF PLASTICS; WORKING OF SUBSTANCES IN A PLASTIC STATE IN GENERAL
B29C	SHAPING OR JOINING OF PLASTICS; SHAPING OF MATERIAL IN A PLASTIC STATE, NOT OTHERWISE PROVIDED FOR; AFTER-TREATMENT OF THE SHAPED PRODUCTS, e.g. REPAIRING (making preforms B29B11/00; making laminated products by combining previously

CPC/IPC/FI Symbols	Description
	unconnected layers which become one product whose layers will remain together B32B37/00 - B32B41/00)
B29C64/00	Additive manufacturing, i.e. manufacturing of three-dimensional [3D] objects by additive deposition, additive agglomeration or additive layering, e.g. by 3D printing, stereolithography or selective laser sintering
B33	ADDITIVE MANUFACTURING TECHNOLOGY
B33Y	ADDITIVE MANUFACTURING, i.e. MANUFACTURING OF THREE-DIMENSIONAL [3-D] OBJECTS BY ADDITIVE DEPOSITION, ADDITIVE AGGLOMERATION OR ADDITIVE LAYERING, e.g. BY 3-D PRINTING, STEREOLITHOGRAPHY OR SELECTIVE LASER SINTERING
B33Y10/00	Processes of additive manufacturing
B33Y30/00	Apparatus for additive manufacturing; Details thereof or accessories therefor
B33Y40/00	Auxiliary operations or equipment, e.g. for material handling
B33Y50/00	Data acquisition or data processing for additive manufacturing
B33Y70/00	Materials specially adapted for additive manufacturing
B33Y80/00	Products made by additive manufacturing
B33Y99/00	Subject matter not provided for in other groups of this subclass
B81	MICROSTRUCTURAL TECHNOLOGY
B81C	PROCESSES OR APPARATUS SPECIALLY ADAPTED FOR THE MANUFACTURE OR TREATMENT OF MICROSTRUCTURAL DEVICES OR SYSTEMS (making microcapsules or microballoons B01J13/02; processes or apparatus peculiar to the manufacture or treatment of piezo-electric, electrostrictive or magnetostrictive element per se H01L41/22)
B81C2201/00	Manufacture or treatment of microstructural devices or systems
B81C2201/01	. in or on a substrate
B81C2201/0174	.. for making multi-layered devices, film deposition or growing
B81C2201/0183	... Selective deposition
B81C2201/0184	.... Digital lithography, e.g. using an inkjet print-head
C	CHEMISTRY; METALLURGY
C04	CEMENTS; CONCRETE; ARTIFICIAL STONE; CERAMICS; REFRACTORIES
C04B	LIME, MAGNESIA; SLAG; CEMENTS; COMPOSITIONS THEREOF, e.g. MORTARS, CONCRETE OR LIKE BUILDING MATERIALS; ARTIFICIAL STONE {(roofing granules E04D7/005)}; CERAMICS (devitrified glass-ceramics C03C10/00); REFRACTORIES; TREATMENT OF NATURAL STONE
C04B2111/00	Mortars, concrete or artificial stone or mixtures to prepare them, characterised by specific function, property or use
C04B2111/00034	. {Physico-chemical characteristics of the mixtures}
C04B2111/00181	.. {Mixtures specially adapted for three-dimensional printing (3DP), stereo-lithography or prototyping}
C04B35	Shaped ceramic products characterised by their composition; Ceramics compositions; Processing powders of inorganic compounds preparatory to the manufacturing of ceramic products
C04B2235/00	Aspects relating to ceramic starting mixtures or sintered ceramic products
C04B2235/60	. Aspects relating to the preparation, properties or mechanical treatment of green bodies or pre-forms
C04B2235/602	.. Making the green bodies or pre-forms by moulding
C04B2235/6026	... Computer aided shaping, e.g. rapid prototyping
G	PHYSICS
G03	PHOTOGRAPHY; CINEMATOGRAPHY; ANALOGOUS TECHNIQUES USING WAVES OTHER THAN OPTICAL WAVES; ELECTROGRAPHY; HOLOGRAPHY
G03F	PHOTOMECHANICAL PRODUCTION OF TEXTURED OR PATTERNED SURFACES, e.g. FOR PRINTING, FOR PROCESSING OF SEMICONDUCTOR DEVICES; MATERIALS THEREFOR; ORIGINALS THEREFOR; APPARATUS SPECIALLY ADAPTED THEREFOR; (phototypographic composing devices B41B; photosensitive materials or processes for photographic purposes G03C; electrophotography, sensitive layers or processes therefor G03G)
G03F7/00	Photomechanical, e.g. photolithographic, production of textured or patterned surfaces, e.g. printing surfaces; Materials therefor, e.g. comprising photoresists; Apparatus specially adapted therefor (using photoresist structures for special production processes, see the relevant places, e.g. B44C, H01L, e.g. H01L21/00, H05K)
G03F7/70	. {Exposure apparatus for microlithography}
G03F7/70375	.. {Imaging systems not otherwise provided for, e.g. multiphoton lithography; Imaging systems comprising means for converting one type of radiation into another type of radiation, systems comprising mask with photo-cathode}

CPC/IPC/FI Symbols	Description
G03F7/70416	... {Stereolithography, 3D printing, rapid prototyping}
G05	CONTROLLING; REGULATING
G05B	CONTROL OR REGULATING SYSTEMS IN GENERAL; FUNCTIONAL ELEMENTS OF SUCH SYSTEMS; MONITORING OR TESTING ARRANGEMENTS FOR SUCH SYSTEMS OR ELEMENTS (fluid-pressure actuators or systems acting by means of fluids in general F15B; valves per se F16K; characterised by mechanical features only G05G; sensitive elements, see the appropriate subclass, e.g. G12B, subclass of G01, H01; correcting units, see the appropriate subclass, e.g. H02K)
G05B2219/00	Program-control systems
G05B2219/30	. Nc systems
G05B2219/49	.. Nc machine tool, till multiple
G05B2219/49002	... Map unfolded surface on flat surface to make dies, composite objects, free form
G05B2219/49003	... Make two halves of tool, model at the same time
G05B2219/49004	... Modeling, making, manufacturing model to control machine, cmm
G05B2219/49005	... Map 2-D pattern on 3-D
G05B2219/49006	... Nc machine makes cams, model to control, or make a copy, on other machines
G05B2219/49007	... Making, forming 3-D object, model, surface
G05B2219/49008	... Making 3-D object with model in computer memory
G05B2219/49009	... Model stored in a memory of a prototype
G05B2219/49011	... Machine 2-D slices, build 3-D model, laminated object manufacturing LOM
G05B2219/49013	... Deposit layers, cured by scanning laser, stereo lithography SLA, prototyping
G05B2219/49014	... Calculate number and form of 2-D slices automatically from volume on screen
G05B2219/49015	... Wire, strang laying, deposit fluid, welding, adhesive, hardening, solidification, fuse
G05B2219/49016	... Desktop manufacturing [DTM]; Solid freeform machining [SFM]; Solid freeform fabrication [SFF]
G05B2219/49017	... DTM desktop manufacturing, prototyping
G05B2219/49018	... Laser sintering of powder in layers, selective laser sintering SLS
G05B2219/49019	... Machine 3-D slices, to build 3-D model, stratified object manufacturing SOM
G05B2219/49021	... Deposit layer, machine, mill layer, then new layer, SDM solid deposit manufacting
G05B2219/49022	... Photo masking, mask cures whole layer at one time, add wax, mill, new layer
G05B2219/49023	... 3-D printing, layer of powder, add drops of binder in layer, new powder
G05B2219/49024	... LEM laminated engineering materials, like lom but first cut, then stack
G05B2219/49025	... By positioning plurality of rods, pins to form together a mold, maquette
G05B2219/49026	... SDM shape deposition manufacturing for multimaterial layers
G05B2219/49027	... SALD selective area laser deposition, vapor solidifies on surface
G05B2219/49028	... Rapid freeze prototyping, selectively deposit and rapidly freeze water layer by layer
G05B2219/49029	... Virtual rapid prototyping, create a virtual prototype, simulate rapid prototyping process
G05B2219/49031	... Project particles, laser beam to point using two, more jets, beams, ballistic particle
G05B2219/49033	... Blanks or taken from roll of metal sheet
G05B2219/49034	... Changing design, use same prototype, add reinforcements where needed
G05B2219/49035	... Reconstruct boundary volume from stack of layer contours, sections
G05B2219/49036	... Use quality measures, build time, strength of material, surface approximation
G05B2219/49037	... Electro rheological fluid to build support for overhanging parts, particle jet
G05B2219/49038	... Support help, grid between support and prototype, separate easily
G05B2219/49039	... Build layer of different, weaker material between support and prototype
G06F2113/00	Details relating to the application field
G06F2113/10	. Additive manufacturing, e.g. 3D printing
H	ELECTRICITY
H05	ELECTRIC TECHNIQUES NOT OTHERWISE PROVIDED FOR
H05K	PRINTED CIRCUITS; CASINGS OR CONSTRUCTIONAL DETAILS OF ELECTRIC APPARATUS; MANUFACTURE OF ASSEMBLAGES OF ELECTRICAL COMPONENTS
H05K3/00	Apparatus or processes for manufacturing printed circuits
H05K3/0011	. {Working of insulating substrates or insulating layers}
H05K3/0014	.. {Shaping of the substrate, e.g. by moulding}
H05K3/46	. Manufacturing multilayer circuits

CPC/IPC/FI Symbols	Description
H05K3/4644	.. {by building the multilayer layer by layer, i.e. build-up multilayer circuits (making via holes in the insulating layers H05K3/0011; special circuit boards as base or core whereon the multilayer is built H05K3/4602)}
H05K3/4664	... {Adding a circuit layer by thick film methods, e.g. printing techniques or by other techniques for making conductive patterns by using pastes, inks or powders (H05K3/4647 takes precedence)}
Y	GENERAL TAGGING OF NEW TECHNOLOGICAL DEVELOPMENTS; GENERAL TAGGING OF CROSS-SECTIONAL TECHNOLOGIES SPANNING OVER SEVERAL SECTIONS OF THE IPC; TECHNICAL SUBJECTS COVERED BY FORMER USPC CROSS-REFERENCE ART COLLECTIONS [XRACs] AND DIGESTS
Y02	TECHNOLOGIES OR APPLICATIONS FOR MITIGATION OR ADAPTATION AGAINST CLIMATE CHANGE
Y02P	CLIMATE CHANGE MITIGATION TECHNOLOGIES IN THE PRODUCTION OR PROCESSING OF GOODS
Y02P10/00	Technologies related to metal processing
Y02P10/25	. Process efficiency

The complete description of the CPC classes with IPC- and FI-concordances can be found in the Internet at https://www.wipo.int/classifications/ipc/ipcpub/?notion=scheme&fipcpc=yes.

2.2 Japanese F-Terms Classification

FTCLA Symbols	Description
4F213	MOULDING TECHNIQUES NOT OTHERWISE PROVIDED FOR, E.G. MOULDING PLASTICS; COMBINATIONS OF MOULDINGS (NO ALTERATION) (FI coverage: B29C64/00, B33Y10/00 – B33Y99/00)
4K018	POWDER METALLURGY (FI coverage B22F1/00 – B22F8/00, B22F10/00 – B22F12/99)

The complete description of the F-Terms can be found in the Internet at https://www.j-platpat.inpit.go.jp/p1101.

3 Keywords

The following keyword concepts were used:

- rapid prototyping, additive manufacturing
- stereolithography, fused deposition modelling, freeform fabrication,
- laser sintering, laser melting, selective sintering, selective melting, direct metal deposition
- layer-by-layer deposition, laminated object
- 3D/three dimensional and printing/plotting/laminating
- 3D object/model and bioprinting/multi-jet/binder jetting/drop-on-demand
- 4D printing, 5D printing or 6D printing

4 Confidence Interval for Precision

Precision is expressed in percent of relevant counts. The 95 % confidence interval for the precision of a technology field is assessed on a set of 100 randomly selected patent families based on a binomial distribution.

Precision Confidence Interval: 50 – 69 %

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5 History

Version	latest update	Comment
_03_25	03.04.2025	Additional IPC, CPC and keyword concepts, FTerms restricted with keyword concepts in TAC; pd>=1985
_09_24	19.09.2024	Confidence Intervall of Precision updated
_03_24	28.03.2024	additional IPC, CPC and keyword concepts in title, abstrac, claims; confidence interval of precision updated
_03_23	30.03.2023	CPC Y02P10/29 no longer exist, althogh it is still listed in PatentSigth field “CPC smart”; Confidence intervall of precision updated
_09_22	27.09.2022	keyword search in fields title, abstract, claim only; confidence intervall of precision updated
_03_22	31.03.2022	Confidence Intervall of Precision updated
_08_21	16.08.2021	Confidence Intervall of Precision updated
_03_21	16.03.2021	Confidence Intervall of Precision updated
_09_20	25.08.2020	CPC supplemented; keyword search in PatentSight instead of PatBase
_12_19	21.05.2019	Eliminated class B23C67, used IPC2020
_09_19	22.08.2019	No change
_05_19	13.01.2020	Refined strategy

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