CPC field-specific training

B29C "Shaping or joining of plastics"
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Introduction to B29C

Introduction

- B29C deals shaping or joining of plastic materials and covers many moulding techniques such as injection moulding, extrusion moulding, blow moulding, well known for the mass production of "every day" items.

- This presentation will focus on:
  - B29C64: Additive manufacturing of plastic materials as it is a booming technologies from the fourth industrial revolution;
  - B29C70: massively used in "green technologies" such as wind turbine blades.
Introduction to B29C

Hierarchy

B29C
Shaping or joining of **plastics**; shaping of a material in a **plastic state**, not otherwise provided for; after-treatment of shaped products, e.g. repairing.

B29C70
Shaping composites, i.e. **plastic material** comprising reinforcements, fillers or preformed parts, e.g. inserts.

B29C64
Additive Manufacturing Technology
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B29C64 Additive Manufacturing

- **Introduction**
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- Examples
Introduction

- Additive Manufacturing also known as 3D printing refers to processes used to create 3D objects in which successive layers of material are formed under computer control to create an object. Objects can be of almost any shape or geometry and typically are produced using digital model data from a 3D model.

- Additive Manufacturing is a manufacturing technique of the 4th industrial revolution.
Introduction

- 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.

- **New scheme** (2017-08)
  - at CPC level: B29C67/0051 was a "hidden scheme". The technical field needed to be more visible.
  - B29C67/0051 had no detail regarding apparatus features.
  - at IPC level: B29C67/00, high level, no detail.
Introduction

- WARNING: reclassification incomplete at CPC and IPC level!
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What and where to classify; neighbouring fields

- B29C64 covers processes, apparatus and other aspects of additive manufacturing for producing, repairing or modifying three-dimensionally shaped structures by selectively depositing successive layers of material one upon each other.

- B29C64 covers additive manufacturing of plastic materials or materials in a plastic state.
What and where to classify; neighbouring fields

- B33Y covers additive manufacturing irrespective of the process or material used.

- Subclass B33Y is for obligatory supplementary classification of subject-matter containing an aspect of additive manufacturing already classified as such in other classification places.
What and where to classify; neighbouring fields

Additive Manufacturing Technology

Metals
B22F3/1055

B33Y10/00

Plastics
B29C64/00

Ceramics
B28B1/001

B33Y10/00

European Patent Office
What and where to classify; neighbouring fields

- 3D Modelling G06T17/00
- Program-control system G05B19/00
- Photosensitive materials G03F7/004

Additive Manufacturing Technology

- Metals B22F3/1055
- Plastics B29C64/00
- Ceramics B28B1/001
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Criteria for including/excluding documents

Processes and apparatus of additive manufacturing:

- If the material used is a plastic material or a material in a plastic state, the document has to be classified in B29C64;

- If the material used is not relevant (plastic or metal or ceramic or others) or not specified, the document has to be classified in B29C64.
Criteria for including/excluding documents

- **Products**: products as such obtained by a process of additive manufacturing are not classified in B29C64. They have to be classified in the product field and be given the code B33Y80 as obligatory supplementary classification symbol.

- **Materials**: materials as such used for additive manufacturing are not classified in B29C64. They have to be classified in the relevant class and be given the code B33Y70 as obligatory supplementary classification symbol.
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Specific terminology

- According to ASTM standard F2792, the correct terminology is Additive Manufacturing.

- The terms 3D printing and Rapid Prototyping are very often used as synonyms.
## Specific terminology

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLS</td>
<td>Selective Laser sintering</td>
</tr>
<tr>
<td>SLM</td>
<td>Selective Laser Melting</td>
</tr>
<tr>
<td>SFF</td>
<td>Solid Freeform Fabrication</td>
</tr>
<tr>
<td>FDM</td>
<td>Fused Deposition Modelling</td>
</tr>
<tr>
<td>LOM</td>
<td>Laminated Object Modelling</td>
</tr>
<tr>
<td>SDM</td>
<td>Selective Deposition Modelling</td>
</tr>
<tr>
<td>3D Printing</td>
<td>Three Dimensional Printing</td>
</tr>
<tr>
<td>RP</td>
<td>Rapid Prototyping</td>
</tr>
<tr>
<td>DTM</td>
<td>Desktop Manufacturing</td>
</tr>
</tbody>
</table>
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### Overall structure

#### Main sub-groups:

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<thead>
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<th>Sub-group</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>B29C 64/10</td>
<td>Processes of additive manufacture</td>
</tr>
<tr>
<td>B29C 64/20</td>
<td>Apparatus for additive manufacturing; Details thereof or accessories thereof</td>
</tr>
<tr>
<td>B29C 64/30</td>
<td>Auxiliary operations or equipment</td>
</tr>
<tr>
<td>B29C 64/40</td>
<td>Structures for supporting 3D objects during manufacture and intended to be sacrificed after completion thereof</td>
</tr>
</tbody>
</table>
### Overall structure

<table>
<thead>
<tr>
<th>B29C 64/10</th>
<th>• Processes of additive manufacture</th>
</tr>
</thead>
<tbody>
<tr>
<td>▲ ! Physical state/condition of the materials is highly relevant!</td>
<td></td>
</tr>
<tr>
<td><strong>B29C 64/106</strong></td>
<td>• • using only liquids or viscous materials, e.g. depositing a continuous bead of viscous material</td>
</tr>
<tr>
<td><strong>B29C 64/141</strong></td>
<td>• • using only solid materials</td>
</tr>
<tr>
<td><strong>B29C 64/147</strong></td>
<td>• • • using sheet material, e.g. laminated object manufacturing [LOM] or laminating sheet material precut to local cross sections of the 3D object</td>
</tr>
<tr>
<td><strong>B29C 64/153</strong></td>
<td>• • • using layers of powder being selectively joined, e.g. by selective laser sintering or melting</td>
</tr>
<tr>
<td><strong>B29C64/159</strong></td>
<td>• • using only gaseous substances, e.g. vapour deposition</td>
</tr>
<tr>
<td><strong>B29C64/165</strong></td>
<td>• • using a combination of solid and fluid materials, e.g. a powder selectively bound by a liquid binder, catalyst or energy absorber</td>
</tr>
</tbody>
</table>
Overall structure

B29C 64/147

... using sheet material, e.g. laminated object manufacturing [LOM] or laminating sheet material precut to local cross sections of the 3D object
Overall structure

B29C 64/10  •  Processes of additive manufacture

Additional aspects related to processes (not depending on the physical state/condition of the material)

B29C 64/171  •  • specially adapted for manufacturing multiple 3D objects

B29C 64/188  •  • involving additional operations performed on the added layers, e.g. smoothing, grinding or thickness control
Overall structure

B29C 64/153 • • • using layers of powder being selectively joined, e.g. by selective laser sintering or melting

DE 10 2005 022 308 A1 2006.11.23
Anhängende Zeichnungen
Overall structure

B29C 64/20  • Apparatus for additive manufacturing; Details thereof or accessories thereof

B29C 64/205  • • Means for applying layers

B29C 64/209  • • • Heads; Nozzles

B29C 64/214  • • • Doctor Blades

B29C 64/218  • • • Rollers

B29C 69/223  • • • Foils or films, e.g. for transferring layers of building material from one working station to another
## Overall structure

<table>
<thead>
<tr>
<th>Classification Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B29C 64/20</td>
<td>Apparatus for additive manufacturing; Details thereof or accessories thereof</td>
</tr>
<tr>
<td>B29C 64/264</td>
<td>Arrangements for irradiation</td>
</tr>
<tr>
<td>B29C 64/268</td>
<td>Using lase beams; using electron beams</td>
</tr>
<tr>
<td>B29C 64/273</td>
<td>Pulses; frequency modulated</td>
</tr>
<tr>
<td>B29C 64/277</td>
<td>Using multiple radiation means, e.g. micro-mirrors or multiple light emitting diodes (LED)</td>
</tr>
<tr>
<td>B29C 64/286</td>
<td>Optical filters, e.g. masks</td>
</tr>
<tr>
<td>B29C 64/291</td>
<td>for operating globally, e.g. together with selectively applied activators or inhibitors</td>
</tr>
</tbody>
</table>
# Overall structure

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B29C 64/30</td>
<td>• Auxiliary operations or equipment</td>
</tr>
<tr>
<td>B29C 64/307</td>
<td>• Handling of material to be used in additive manufacturing</td>
</tr>
<tr>
<td>B29C 64/314</td>
<td>• Preparation</td>
</tr>
<tr>
<td>B29C 64/321</td>
<td>• Feeding</td>
</tr>
<tr>
<td>B29C 64/329</td>
<td>• using hoppers</td>
</tr>
<tr>
<td>B29C 64/336</td>
<td>• • of two or more materials</td>
</tr>
<tr>
<td>B29C 64/343</td>
<td>• Metering</td>
</tr>
<tr>
<td>B29C 64/35</td>
<td>• Cleaning</td>
</tr>
<tr>
<td>B29C 64/357</td>
<td>• Recycling</td>
</tr>
<tr>
<td>B29C 64/364</td>
<td>• Conditioning of environment</td>
</tr>
<tr>
<td>B29C 64/371</td>
<td>• • using an environment other than air, e.g. inert gas</td>
</tr>
<tr>
<td>B29C 64/379</td>
<td>• • Handling of additively manufactured objects, e.g. using robots</td>
</tr>
<tr>
<td>B29C 64/386</td>
<td>• • Data acquisition or data processing for additive manufacturing</td>
</tr>
<tr>
<td>B29C 64/393</td>
<td>• • for controlling or regulating additive manufacturing processes</td>
</tr>
</tbody>
</table>
Overall structure

B29C 64/40 • Structures for supporting 3D objects during manufacture and intended to be sacrificed after completion thereof
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Examples

3D Printing process has to be classified in B29C64/165: a binder material is deposited onto a powder bed with inkjet printer heads layer by layer.
Examples

Fused Deposition Modelling has to be classified in B29C64/118
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- Groups under B29C70 Shaping composites
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B29C70 Shaping composites

- Introduction to B29C70
- What and where to classify; neighbouring fields
- Criteria for including/excluding documents
- Specific terminology
- Overall structure and examples
Introduction

- A composite material is a material made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from those of the individual components. The individual components remain separate and distinct within the finished structure, differentiating composites from mixtures and solid solutions.

- The new material may be preferred for many reasons: common examples include materials which are stronger, lighter, or less expensive when compared to traditional materials.
Introduction
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B29C70 Shaping composites

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- What and where to classify; neighbouring fields
- Criteria for including/excluding documents
- Specific terminology
- Overall structure and examples
What and where to classify; neighbouring fields

B29C
Shaping or joining of \textit{plastics}; shaping of a material in a \textit{plastic state}, not otherwise provided for; after-treatment of shaped products, e.g. repairing.

B29C70
Shaping composites, i.e. \textit{plastic material} comprising reinforcements, fillers or preformed parts, e.g. inserts.
What and where to classify; neighbouring fields

Nanocomposites
B82Y30/00, C05J5/005
Y01N6/00

Making Preforms
B29B11/16

Fibre reinforced metals
C22C49/44

Laminates
B32B

Fibre-reinforced ceramics
C04B35/80

Carbon-carbon composites
C04B35/83
What and where to classify; neighbouring fields

Processes for making specific composite products:

- B29D99/0003. Producing profiled members, e.g. beams
- B29D99/001. Producing wall or panel-like structures, e.g. for hulls, fuselages, or buildings (articles with hollow walls B29D24/00)
- B29D99/0025. Producing blades or the like, e.g. blades for turbines, propellers or wings
- B29D99/0089. Producing honeycomb structures
- B29D24/00. Producing articles with hollow walls
## What and where to classify; neighbouring fields

### Processes for making specific composite products:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B29D99/0003</td>
<td>Producing profiled members, e.g. beams</td>
</tr>
<tr>
<td>B29D99/001</td>
<td>Producing wall or panel-like structures, e.g. for hulls, fuselages, or buildings (articles with hollow walls B29D24/00)</td>
</tr>
<tr>
<td>B29D99/0025</td>
<td>Producing blades or the like, e.g. blades for turbines, propellers or wings</td>
</tr>
<tr>
<td>B29D99/0089</td>
<td>Producing honeycomb structures</td>
</tr>
<tr>
<td>B29D24/00</td>
<td>Producing articles with hollow walls</td>
</tr>
</tbody>
</table>
What and where to classify; neighbouring fields

Neighbouring fields in B29C

- B29C33 Moulds
- B29C35 Heating/Cooling
- B29C53/56 Winding
- B29C43 Compression Moulding
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B29C70 Shaping composites

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- What and where to classify; neighbouring fields
  - Criteria for including/excluding documents
- Specific terminology
- Overall structure and examples
Criteria for including/excluding documents

- **Products** as such are not classified in B29C70. They have to be classified in the relevant product group and/or be given an additional classification symbol under B29L.

- **Materials** as such are not classified in B29C70. They have to be classified in the relevant material group and/or be given an additional classification symbol under B29K.
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B29C70 Shaping composites

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Specific terminology

- **Reinforcement**: structure in the form of fibres, wires, rods, bars, sections, plates or blocks which improves the strength of an article.

- **Filler**: a relatively inert substance in the form of particles, powder, beads, flakes or spheres which improves the physical properties or increases the bulk or weight of an article.

- **Preformed part**: part made of any material, being completely shaped to have a determined form and which is not used as a reinforcement: wires or nets forced only into the surface of an article.

- **Insert**: preformed part incorporated in an article during moulding.
Specific terminology

- **Fiber or fibre**: general expression for a reinforcement in the form of a bundle of filaments.

- **Filament**: single reinforcing body of high aspect ratio typically produced artificially or of a natural source.

- **Roving**: bundle of fibres or collection of a large number of filaments resulting in a bundle of substantial higher cross-section than a fibre alone.

- **Whisker**: typically a filament of short length.
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- Overall structure and examples
Overall structure and examples

- B29C70/02 comprising **combinations of reinforcements**, {e.g. non-specified reinforcements, fibrous reinforcing inserts} and **fillers**, {e.g. particulate fillers}, incorporated in **matrix material**, forming one or more layers and with or without non-reinforced or non-filled layers {((combinations of fibrous reinforcement only B29C70/04; combinations of fillers only B29C70/58; combinations with non reinforcing inserts, e.g. foam blocks, B29C70/68))}

- This place does not cover shaping composites of combinations of different types of fibres (B29C70/08).
Overall structure and examples

- B29C70/04 comprising reinforcements only, e.g. self-reinforcing plastics

- This place covers heating and fusing of thermoplastic fibres or high aspect ratio elements with high molecular orientation, without the use of a matrix material or with matrix material of the same thermoplastic material as the fibres, yielding a plastic product with anisotropic properties.

- Example: heating and compressing of HDPE or PP fibres.
Overall structure and examples

- B29C70/06 .. Fibrous reinforcements only

- This is not a subgroup of self reinforced plastics unlike the title of B29C 70/04 suggests.

- This is in fact the head group of fibre reinforced polymers where there is a distinct fibrous reinforcement and a polymer matrix material.
Overall structure and examples

*(54)* Composite elements with controlled electrical conduction

*(57)* Composite materials, methods for making and processing these materials, and systems for using the composite material are described. The disclosed composite material (or composite member) includes a plurality of continuous filaments (110) and can include fiber-like and/or particulate materials (124) incorporated within a binder polymer (134). For example, the composite member of filaments (110) can include fibril-shaped, semi-conductive elements (124) that are contained in a suitable binder polymer (134) to achieve a particular resistance value, wherein the filaments can be integrated and interlinked in a manner as to create an array of resistive elements that precisely define and control current flows through a device formed of the composite material. The composite member can therefore have resistive characteristics and, none or negligibly low amount of capacitive or inductive characteristics. The composite member can be used in market for electrical testing devices, e.g., as high performance, dynamic probes/sensors for very frequency and/or complex mixed-frequency signals.

**FIG. 1B**

Classified in:
- B29C70/025 (under B29C70/02): combinations of fibrous reinforcement and filler.
- B29C70/081 (under B29C70/06): combinations of fibres of continuous or substantial length and short fibres.
Overall structure and examples

- B29C70/28  .. Shaping operations therefor

- This group covers:
  - the shaping of a coherent fibrous reinforcements which are pre-impregnated or without binder;
  - or of non-coherent reinforcements of fibres in a mould or on a support;
  - the impregnation or introduction of a plastics matrix in reinforcements during shaping.
Overall structure and examples

- B29C70/28 does not cover:
  - the moulding by a single technique of plastics matrix material mixed with and containing reinforcing fibres of short length, which is covered by the appropriate place for that technique (injection, extrusion and other processes);
  - the pre-treatment, e.g. impregnation, of reinforcements per se, i.e. independently of their shaping, which is covered by group B29B15/08
Overall structure and examples

- B29C70/30 ... Shaping by lay-up, i.e. applying fibres, tape or broadsheet on a mould, former or core; Shaping by spray-up, i.e. spraying of fibres on a mould, former or core {(by winding and joining, e.g. filament winding B29C53/56 ; for building tyres B29D30/08)}

- B29C 70/30 deals with **lay-up specific details**. Lay-up is the positioning of reinforcements in or on a mould, former, core or substrate taking into account the anisotropy of the material.
Overall structure and examples

Classified in:
B29C70/305 (under B29C70/30): spray-up of reinforcing fibres with or without matrix to form a non-coherent mat in or on a mould
Overall structure and examples

- B29C70/40: ... Shaping or impregnating by compression (B29C70/34 takes precedence)

- B29C 70/40 up to and including B29C 70/56 deals with moulding specific details.

- This place does not cover lay-up specific details (B29C70/30).
Overall structure and examples

Classified in:
B29C70/443 (under B29C70/40 and B29C70/44: using isostatic pressure) and impregnating by vacuum or injection
Overall structure and examples

- B29C70/54 ... Component parts, details or accessories; Auxiliary operations {, e.g. feeding or storage of prepregs or SMC after impregnation or during ageing (pre-treatment, e.g. impregnation, of reinforcements B29B15/08)}

- This group covers all details and auxiliary operations related to shaping of composites consisting of reinforcements only, e.g. sensing means to control curing, impregnation, positioning reinforcements in a mould, perforating, cutting or machining during or after moulding.
Overall structure and examples

Classified in:
B29C70/541: positioning reinforcements in a mould, e.g. using clamping means for the reinforcement (positioning inserts in moulds B29C33/12; lay-up on a mould B29C70/30)
Overall structure and examples

B29C70/58 . comprising fillers only {, e.g. particles, powder, beads, flakes, spheres ( B29C70/025 takes precedence, agglomerating hollow spheres to produce synthetic foam B29C70/66 ; compounding ingredients per se C08K )} - note: Moulding of plastics matrix material mixed with fillers by a single technique is classified in the appropriate place for that technique.
Overall structure and examples

FIG. 2

1 glitter material
2 skin layer
3 core layer

Classified in:
B29C70/585: incorporation of light reflecting filler, e.g. lamellae to obtain pearlescent effect
Overall structure and examples

- B29C70/68. by incorporating or moulding on preformed parts, e.g. inserts or layers, foam blocks.

- This group does not cover:
  - incorporating, or moulding on, preformed parts by a single technique, which is covered by the appropriate place for that technique;
  - pre-treatment of preformed parts per se, i.e. independently of their shaping, which is covered by group B29B15/00.
## Overall structure and examples

<table>
<thead>
<tr>
<th>Inserts related entry</th>
<th>Relevant group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning inserts in moulds</td>
<td>B29C33/12-B29C33/18</td>
</tr>
<tr>
<td>Casting around inserts</td>
<td>B29C39/18</td>
</tr>
<tr>
<td>Coating a mould with inserts</td>
<td>B29C41/30</td>
</tr>
<tr>
<td>Compression moulding with inserts</td>
<td>B29C43/18</td>
</tr>
<tr>
<td>Foaming with inserts</td>
<td>B29C44/12-B29C44/16</td>
</tr>
<tr>
<td>Injection moulding with inserts</td>
<td>B29C45/14</td>
</tr>
<tr>
<td>Extrusion moulding with inserts</td>
<td>B29C47/02</td>
</tr>
<tr>
<td>Blow moulding with labels</td>
<td>B29C49/24-B29C49/26</td>
</tr>
</tbody>
</table>
Overall structure and examples

Classified in:
B29C70/72: encapsulating inserts having non-encapsulated projections, e.g. extremities or terminal portions of electrical components
Overall structure and examples

Classified in:
B29C70/766 (under B29C70/76: Moulding on edges or extremities of the preformed part) on the end part of a tubular article
Overall structure and examples

- B29C70/88 characterised primarily by possessing specific properties, e.g. electrically conductive or locally reinforced
Overall structures and examples

Classified in:
B29C 70/882: partly or totally electrically conductive, e.g. for EMI shielding (conductive floors or floor coverings H05F 3/025; EMI shielding in general H05K 9/00)
Overall structure and examples

Classified in:
B29C70/885: with incorporated metallic wires, nets, films or plates (as lost heating elements B29C35/0272, B29C61/0625)
Thank you for your attention!