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Additive manufacturing — General principles —

Part 1: Terminology

*Fabrication additive — Principes généraux —
Partie 1: Terminologie*

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Contents

Page

Foreword	iv
Introduction.....	v
1 Scope	1
2 Terms and definitions	1
2.1 General terms	1
2.2 Process categories	2
2.3 Processing: General	3
2.4 Processing: Data	6
2.5 Processing: Material	8
2.6 Applications	9
2.7 Properties	10
Annex A (informative) Basic principles	12
A.1 Additive shaping of materials	12
A.2 Single-step and multi-step additive manufacturing processes	13
A.3 Additive manufacturing processing principles	13
A.3.1 Overview of AM single-step processing principles	14
A.3.2 Overview of AM multi-step processing principles	15
Bibliography	17
Alphabetical index	18

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 17296-1 was prepared by Technical Committee ISO/TC-261, *Additive Manufacturing* in cooperation with ASTM F 42 on the basis of a partnership agreement between ISO and ASTM International with the aim to create a common set of ISO/ASTM standards on Additive Manufacturing.

ISO 17296 consists of the following parts, under the general title *Additive manufacturing — General principles*:

- Part 1: Terminology
- Part 2: Overview of process categories and feedstock
- Part 3: Main characteristics and corresponding test methods
- Part 4: Overview of data processing

Introduction

Additive manufacturing is the general term for those technologies that based on a geometrical representation creates physical objects by successive addition of material. These technologies are presently used for various applications in engineering industry as well as other areas of society, such as medicine, education, architecture, cartography, toys and entertainment.

During the development of additive manufacturing technology there have been numerous different terms and definitions in use, often with reference to specific application areas and trademarks. This is often ambiguous and confusing which hampers communication and wider application of this technology.

It is the intention of this international standard to provide a basic understanding of the fundamental principles for additive manufacturing processes, and based on this, to give clear definitions for terms and nomenclature associated with additive manufacturing technology. The objective of this standardization of terminology for additive manufacturing is to facilitate communication between people involved in this field of technology on a world-wide basis.

This international standard has been developed in close cooperation of ISO/TC 261 and ASTM F 42 on basis of a partnership agreement between ISO and ASTM International with the aim to create a common set of ISO/ASTM standards on Additive Manufacturing.

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Additive manufacturing — General principles — Part 1: Terminology

1 Scope

This part of ISO 17296 establishes and defines terms used in additive manufacturing (AM) technology, which applies the additive shaping principle and thereby builds physical 3D geometries by successive addition of material.

The terms have been classified into specific fields of application.

New terms emerging from the future work within ISO/TC 261 will be included in upcoming amendments and overviews of this international standard.

2 Terms and definitions

2.1 General terms

2.1.1

3D printer, noun
machine used for *3D printing* (2.3.1).

2.1.2

additive manufacturing, noun
AM
process of joining materials to make *parts* (2.6.1) or objects from 3D model data, usually *layer* (2.3.10) upon layer, as opposed to subtractive manufacturing and formative manufacturing methodologies

Note 1 to entry: historical terms: additive fabrication, additive processes, additive techniques, additive layer manufacturing, layer manufacturing, solid freeform fabrication and freeform fabrication.

Note 2 to entry: the meaning of "additive-", "subtractive-" and "formative-" manufacturing methodologies are further discussed in Annex A.

2.1.3

additive system, noun
additive manufacturing system
additive manufacturing equipment
machine and auxiliary equipment used for *additive manufacturing* (2.1.2)

2.1.4

AM machine, noun
section of the *additive manufacturing system* (2.1.3) including hardware, machine control software, required set-up software and peripheral accessories necessary to complete a *build cycle* (2.3.3) for producing *parts* (2.6.1)

2.1.5

AM machine user, noun
operator of or entity using an *AM machine* (2.1.4)

2.1.6

AM system user, noun

additive system user

operator of or entity using an entire *additive manufacturing system* (2.1.3) or any component of an additive system

2.1.7

front, noun

<of a machine; -unless otherwise designated by the machine builder> side of the machine that the operator faces to access the user interface or primary viewing window, or both

2.1.8

material supplier, noun

provider of material/ *feedstock* (2.5.2) to be processed in *additive manufacturing equipment* (2.1.3)

2.1.9

multi-step process, noun

type of *additive manufacturing* (2.1.2) process in which *parts* (2.6.1) are fabricated in two or more operations where the first typically provides the basic geometric shape and the following consolidates the part to the intended basic material properties

Note 1 to entry: Removal of the support structure and cleaning may be necessary, however in this context not considered as a separate process step.

Note 2 to entry: The principle of *single-step* (2.1.10) and multi-step processes are further discussed in Annex A.

2.1.10

single-step process, noun

type of *additive manufacturing* (2.1.2) process in which *parts* (2.6.1) are fabricated in a single operation where the basic geometric shape and basic material properties of the intended product are achieved simultaneously

Note 1 to entry: Removal of the support structure and cleaning may be necessary, however in this context not considered as a separate process step.

Note 2 to entry: The principle of single-step and *multi-step processes* (2.1.9) are further discussed in Annex A.

2.2 Process categories

2.2.1

binder jetting, noun

additive manufacturing (2.1.2) process in which a liquid bonding agent is selectively deposited to join powder materials

2.2.2

directed energy deposition, noun

additive manufacturing (2.1.2) process in which focused thermal energy is used to fuse materials by melting as they are being deposited

Note 1 to entry: "Focused thermal energy" means that an energy source (e.g., laser, electron beam, or plasma arc) is focused to melt the materials being deposited

2.2.3

material extrusion, noun

additive manufacturing (2.1.2) process in which material is selectively dispensed through a nozzle or orifice

2.2.4**material jetting**, noun*additive manufacturing* (2.1.2) process in which droplets of build material are selectively deposited

Note 1 to entry: Example materials include photopolymer and wax.

2.2.5**powder bed fusion**, noun*additive manufacturing* (2.1.2) process in which thermal energy selectively fuses regions of a *powder bed* (2.5.8)**2.2.6****sheet lamination**, noun*additive manufacturing* (2.1.2) process in which sheets of material are bonded to form an object**2.2.7****vat photopolymerization**, noun*additive manufacturing* (2.1.2) process in which liquid photopolymer in a vat is selectively cured by light-activated polymerization**2.3 Processing: General****2.3.1****3D printing**, noun

fabrication of objects through the deposition of a material using a print head, nozzle, or another printer technology

Note 1 to entry: Term often used in a non-technical context synonymously with *additive manufacturing* (2.1.2); until present times this term has in particular been associated with machines that are low end in price and/or overall capability.**2.3.2****build chamber**, nounenclosed location within the *additive manufacturing system* (2.1.3) where the *parts* (2.6.1) are fabricated**2.3.3****build cycle**, nounsingle process cycle in which one or more components are built up in *layers* (2.3.10) in the process chamber of the *AM machine* (2.1.4)**2.3.4****build envelope**, nounlargest external dimensions of the x-, y-, and z-axes within the *build space* (2.3.6) where *parts* (2.6.1) can be fabricated

Note 1 to entry: The dimensions of the build space will be larger than the build envelope.

2.3.5**build platform**, noun

<of a machine> base which provides a surface upon which the build is started and supported throughout the build process

Note 1 to entry: In some systems the *parts* (2.6.1) are built attached to the build platform, either directly or through a support structure. In other systems, such as *powder bed* (2.5.8) systems, no direct mechanical fixture between the build and the platform may be required.

2.3.6

build space, noun

location where the *parts* (2.6.1) may be fabricated, typically within the *build chamber* (2.3.2) or on a *build platform* (2.3.5)

2.3.7

build surface, noun

area where material is added, normally on the last deposited *layer* (2.3.10) which becomes the foundation upon which the next layer is formed

Note 1 to entry: For the first layer the build surface is often the *build platform* (2.3.5).

Note 2 to entry: In the case of direct energy deposition process, the build surface can be an existing part onto which material is added.

Note 3 to entry: If the orientation of the material deposition or consolidation means, or both, is variable, it may be defined relative to the build surface.

2.3.8

build volume, noun

total usable volume available in the machine for building *parts* (2.6.1)

2.3.9

feed region, noun

<in *powder bed fusion* (2.2.5)> location/s in the machine where *feedstock* (2.5.2) is stored and from which a portion of the feedstock is repeatedly conveyed to the part bed during the *build cycle* (2.3.3)

2.3.10

layer, noun

<matter> material laid out, or spread, to create a surface

2.3.11

machine coordinate system, noun

three-dimensional coordinate system as defined by a fixed point on the *build platform* (2.3.5) with the three principal axes labelled x-, y-, and z-, with rotary axis about each of these axis labelled A, B, and C, respectively, where the angles between x-, y- and z- can be Cartesian or defined by the machine manufacturer

2.3.12

manufacturing lot, noun

set of manufactured components having commonality between powder, *production run* (2.3.19), machine, and *post-processing* (2.5.6) steps (if required) as recorded on a single manufacturing work order

2.3.13

origin, noun

zero point

(0, 0, 0) <when using x-, y-, and z-coordinates>

designated universal reference point at which the three primary axes in a coordinate system intersect

Note 1 to entry: Coordinate system can be Cartesian or as defined by the machine manufacturer.

2.3.14

build origin, noun

origin (2.3.13) most commonly located at the centre of the *build platform* (2.3.5) and fixed on the build facing surface, but could be defined otherwise by the build set-up