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Additive manufacturing of metal — Feedstock materials — Powder life cycle management

Fabrication additive de métaux — Matières premières — Gestion du cycle de vie de la poudre

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Foreword

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This document was prepared by Technical Committee ISO/TC 261, *Additive manufacturing*, in cooperation with ASTM Committee F42, *Additive Manufacturing Technologies*, 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, and in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 438, *Additive manufacturing,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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Introduction

Metal powders represent the feedstock for numerous additive manufacturing processes. Specifications and quality of metal powder feedstock are directly related to the quality and performance of components fabricated by additive manufacturing (AM).

During their usage in additive manufacturing processes as well as during storage and handling, powders can be subject to various quality-relevant influencing factors.

These may include:

— cross-contamination and impurities;

— changes in particle size distribution;

— reactions with ambient gases;

— changes in moisture content;

— changes in flow properties;

— changes of particle morphology;

— absorption of welding fumes and spatters;

— changes in chemical composition due to selective evaporation of individual alloying elements.

Quality assurance of the powder materials over the entire service life from receiving, over storage and handling to reuse and disposal is therefore decisive for qualified additive manufacturing processes in any relevant industry.

This document aims to raise awareness of powder quality issues and to describe measures and procedures for quality assurance, batch identification and traceability of powder materials. The proposed measures are derived from best practices in the processing industry with a main emphasis on how frequently and at which stages of the process chain to document certain properties.

NOTE As the metal powder/feedstock is the main input of the AM process, its quality, both incoming and in service, impacts the quality of the AM output. However, the control over the quality of the input is one possible strategy to ensure the quality of the process output. Alternatively, the supplier/manufacturer is allowed to certify the quality of the AM components through

a) validation and verification of the AM process, as per internal procedures, and

b) inspection of the CTQs (critical to quality) of the AM components, as per customer agreement.

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Additive manufacturing of metal — Feedstock materials — Powder life cycle management

1 Scope

This document specifies requirements and describes aspects for the lifecycle management of metal feedstock materials for powder based additive manufacturing processes. These aspects include but are not limited to:

— powder properties;

— powder lifecycle;

— test methods;

— powder quality assurance.

This document supplements ISO/ASTM 52907, which primarily focuses on requirements for virgin powder. This document covers on powder life cycle management, and therefore focuses on control of virgin and used powders.

This document can be used by manufacturers of metal powders, purchasers of powder feedstock for additive manufacturing, those responsible for the quality assurance of additively manufactured parts and suppliers of measurement and testing equipment for characterizing metal powders for use in powder-based additive manufacturing processes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12154, *Determination of density by volumetric displacement — Skeleton density by gas pycnometry*

ISO/ASTM 52900, *Additive manufacturing — General principles — Fundamentals and vocabulary*

ISO/ASTM 52907, *Additive manufacturing — Feedstock materials — Methods to characterize metal powders*

ASTM B923, *Standard Test Method for Metal Powder Skeletal Density by Helium or Nitrogen Pycnometry*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/ASTM 52900 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
split
action of physically or systematically splitting a batch into one or more smaller volumes of powder

Note 1 to entry: It is possible that such action is taken in order to differentiate between volumes of powder used for individual machines but which originate from a single large batch.

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