PD CEN ISO/ASTM TR 52952:2023



BSI Standards Publication

Additive manufacturing of metals — Feedstock materials — Correlating of rotating drum measurement with powder spreadability in PBF-LB machines

National foreword

This Published Document is the UK implementation of CEN ISO/ASTM TR 52952:2023. It is identical to ISO/ASTM TR 52952:2023.

The UK participation in its preparation was entrusted to Technical Committee AMT/8, Additive manufacturing.

A list of organizations represented on this committee can be obtained on request to its committee manager.

BSI, as a member of CEN, is obliged to publish CEN ISO/ASTM TR 52952:2023 as a Published Document. However, attention is drawn to the fact that during the development of this Technical Report, the UK committee voted against its approval due to the following reasons:

- a felt lack of detail in the characterization of layer uniformity, whereby the particle size is not taken into account, and thus the methodology cannot be applied for comparison between feedstocks, nor for quantifying the quality of the layer formed;
- because the definition of layer homogeneity as proposed is used for evaluating whether recoating speed may affect spreadability or not, rather than for evaluating whether a powder feedstock will be recoated appropriately in the application at any speed, limiting the applicability and usefulness of the method; and
- for the results shown, correlations are drawn for only two of the five powders tested, with only three points per sample, and with significant error bars.

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Additive Manufacturing of metals - Feedstock materials - Correlating of rotating drum measurement with powder spreadability in PBF-LB machines (ISO/ASTM TR 52952:2023)

Fabrication additive de métaux - Matières premières - Corrélation de la mesure du tambour rotatif avec la capacité d'étalement de la poudre dans les machines PBF-LB (ISO/ASTM TR 52952:2023)

Additive Fertigung von Metallen - Ausgangsmaterialien - Korrelation zwischen der Messung der rotierenden Trommel und der Pulververteilbarkeit in PBF-LB-Maschinen (ISO/ASTM TR 52952:2023)

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European foreword

This document (CEN ISO/ASTM TR 52952:2023) has been prepared by Technical Committee ISO/TC 261 "Additive manufacturing" in collaboration with Technical Committee CEN/TC 438 “Additive Manufacturing” the secretariat of which is held by AFNOR.

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The text of ISO/ASTM TR 52952:2023 has been approved by CEN as CEN ISO/ASTM TR 52952:2023 without any modification.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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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

Granular materials and fine powders are widely used in industrial applications. To support control and optimize processing methods, these materials have to be precisely characterized. Characterization methods are related either to the properties of the grains (granulometry, morphology, chemical composition, etc.) or to the behaviour of the bulk powder (flowability, density, blend stability, electrostatic properties, etc.). The complex behaviours of granular and powder materials have motivated the development of numerous techniques to obtain reproducible and interpretable results. Many industries are concerned in different fields: additive manufacturing, food processing, pharmaceuticals, bulk material handling. This document is focused on Additive Manufacturing (AM).

Metallic powders are widely used in AM processes involving powder bed fusion (PBF-LB/M PBF-EB/M etc.) or binder jetting. During such operations, successive thin layers of powder are deposited with a blade or with a rotating cylinder. Each layer is then fused (most commonly melted) by an energy beam or joined by an adhesive binder to build the parts. The layer thickness defines the vertical resolution of the process; a thin layer leads to a better resolution. In order to obtain a thin layer, the powder is as fine as possible. However, if it is assumed that among the cohesive forces, the Van der Waal forces are predominant, it can be stated that as the grain size decreases, cohesiveness typically increases[25]. This increase in cohesiveness could have an impact on the spreadability of a powder.

The quality of the parts built with AM is thus directly influenced by powder flow properties.

According to ISO/ASTM 52900, spreadability is the ability of a feedstock material to be spread out in layers that fulfil the requirements for the AM process; this includes the ability to form a flat powder-atmosphere interface without waves and irregularities.

Visual observation of layer homogeneity is usually the only way for operators to assess the spreadability of powders during the spreading of new layers. However, linking the powder characteristics to its spreadability during the layer deposition beforehand can provide a more cost-effective way to classify and select the optimal powder and layer deposition speed combinations.

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TECHNICAL REPORT **ISO/ASTM TR 52952:2023(E)**

Additive manufacturing of metals — Feedstock materials — Correlating of rotating drum measurement with powder spreadability in PBF-LB machines

1 Scope

This document provides an example of the relation between the characterization of certain macroscopic properties of metallic powders and their spreadability in an PBF-LB/M AM machines.

This relation is based on a new technique combining measurements inside a PBF-LB/M machine and image processing developed to quantify the homogeneity of the powder bed layers during spreading.

In this document, the flowability of five metal powders are investigated with an automated rotating drum method, whose dynamic cohesive index measurement is shown to establish a correlation with the spreadability of the powder during the layer deposition operation. Furthemore, the particule size distribution (PSD) and morphology of each powder is characterized before testing by static image analysis method (according to ISO 13322-1).

The general principle of the method is described in Figure 1.

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

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 terminological 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
cohesiveness
physical powder behaviour relating to the degree to which the attractive forces between particles exceed the average particle mass

Note 1 to entry: Cohesive powders are qualified as powders where the attractive force between particles exceed the average particle mass

3.2
powder flowability
ability of a solid bulk material to flow

Note 1 to entry: Powder flowability is a function of multiple factors, and particularly powder size and distribution, see also ISO/ASTM 52907.

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