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PVD multi-layer hard coatings — Composition, structure and properties

Revêtements durs multicouches déposés par PVD — Composition, structure et propriétés

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Foreword

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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, SC 9, *Physical vapor deposition coatings*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Multi-layer hard coatings by physical vapor deposition (PVD), which possess high coating-substrate adhesion, high hardness and good wear resistance, are widely applied on tools and machine parts to improve their service life. Based on the chemical compositions, the mainstream PVD multi-layer hard coatings in the market involve transition metal nitrides and carbides, such as Ti/TiN, TiN/CrN, CrN/AlCrN, TiC/TiCN and CrAlN/AlCrTiSiN. To date, there has been no standard to qualify the composition, structure and properties of these multi-layer hard coatings, which has limited their further development.

This document defines the measurement and evaluation of the composition, microstructure, surface quality, thickness, hardness and tribological properties (such as friction and wear performance) of multi-layer hard coatings. The methods are for the purpose of coating development. Where standards for quality assurance in production exist, they are referred to in this document.

PVD multi-layer hard coatings — Composition, structure and properties

1 Scope

This document specifies the evaluation standard of the composition, structure and properties of multi-layer hard coatings by common physical vapor deposition (PVD), indicating a vacuum deposition method that produces a material source by evaporation, sputtering or related non-chemical ways.

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 4545-1, *Metallic materials — Knoop hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 9220, *Metallic coatings — Measurement of coating thickness — Scanning electron microscope method*

ISO 14577-1, *Metallic materials — Instrumented indentation test for hardness and materials parameters — Part 1: Test method*

ISO 20808, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of friction and wear characteristics of monolithic ceramics by ball-on-disc method*

ISO 26423, *Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of coating thickness by crater-grinding method*

3 Terms and definitions

No terms and definitions are listed in this document.

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 http://www.electropedia.org/

4 Samples for composition, structure and properties evaluation

Samples for the composition, structure and properties evaluation should be coated in the same batch as the products requiring the composition, structure and properties evaluation. The samples should be polished to a mirror finish (R_{pk} < 0,05 µm) before being coated and cleaned using ultrasonic agitation, which immerses them in the correct solution to remove hydrocarbons and other surface contaminants.

5 Testing of composition, structure and properties

5.1 Testing of chemical composition

The chemical composition of PVD multi-layer hard coatings is decided by many factors, including the composition of the evaporator source, the energy density of incident atoms/ions, the deposition