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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Metallic coatings — Measurement of coating thickness — Scanning electron microscope method

Revêtements métalliques — Mesurage de l'épaisseur de revêtement — Méthode au microscope électronique à balayage

Reference number
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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9220 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*.

Annex A of this International Standard is for information only.

Metallic coatings — Measurement of coating thickness — Scanning electron microscope method

1 Scope

This International Standard specifies a method for the measurement of the local thickness of metallic coatings by examination of cross-sections with a scanning electron microscope (SEM). It is destructive and has an uncertainty of less than 10 % or 0,1 µm, whichever is greater. It can be used for thicknesses up to several millimetres, but it is usually more practical to use a light microscope (ISO 1463) when applicable.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1463 : 1982, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method.*

ISO 2064 : 1980, *Metallic and other non-organic coatings — Definitions and conventions concerning the measurement of thickness.*

3 Definition

For the purposes of this International Standard, the following definition applies.

local thickness: The mean of the thickness measurements, of which a specified number is made within a reference area. (See ISO 2064.)

4 Principle

A test specimen is cut, ground, and polished from a cross-section of the coating for metallographic examination by a scanning electron microscope. The measurement is made on a conventional micrograph or on a photograph of the video waveform signal for a single scan across the coating.

5 Instrumentation

5.1 Scanning electron microscope (SEM)

The SEM shall have a resolution capability of 50 nm or better. Suitable instruments are available commercially.

5.2 SEM stage micrometer

A stage micrometer or graticule is required for calibration of the magnification of the SEM. The stage micrometer or graticule shall have an uncertainty of less than 5 % for the magnification employed. Suitable stage micrometers or graticules are available commercially.

6 Factors influencing the measurement results

The following factors may affect the accuracy of a measurement of coating thickness.

6.1 Surface roughness

If the coating or its substrate is rough relative to the coating thickness, one or both of the interfaces bounding the coating cross-section may be too irregular to permit accurate measurement of the average thickness in the field of view.

6.2 Taper of cross-section

If the plane of the cross-section is not perpendicular to the plane of the coating, the measured thickness will be greater than the true thickness. For example, an inclination of 10° to the perpendicular will contribute a 1,5 % error.

6.3 Specimen tilt

Any tilt of the specimen (plane of cross-section) with respect to the SEM beam may result in an inaccurate measurement.

NOTE — If the tilt of the test specimen is different from that used for calibration, inaccuracies may result.

6.4 Coating deformation

Detrimental deformation of the coating can be caused by excessive temperature or pressure during the mounting and preparation of cross-sections of soft coatings or coatings that melt at low temperatures, and by excessive abrasion of brittle materials during preparation of cross-sections.