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# ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION



# ISO RECOMMENDATION

# R 1463

## MEASUREMENT OF METAL AND OXIDE COATING THICKNESSES BY MICROSCOPICAL EXAMINATION OF CROSS-SECTIONS

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## BRIEF HISTORY

The ISO Recommendation R 1463, *Measurement of metal and oxide coating thicknesses by microscopical examination of cross-sections,* was drawn up by Technical Committee ISO/TC 107, *Metallic and other non-organic coatings,* the Secretariat of which is held by the Ente Nazionale Italiano di Unificazione (UNI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1463 which was circulated to all the ISO Member Bodies for enquiry in May 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

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|---|---|---|
| Australia | Israel | Sweden |
| Chile | Italy | Switzerland |
| Czechoslovakia | Netherlands | Thailand |
| Finland | New Zealand | Turkey |
| France | Norway | U.A.R. |
| Germany | Poland | United Kingdom |
| Hungary | Portugal | U.S.A. |
| India | South Africa, Rep. of | |
| Iran | Spain | |

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in April 1970, to accept it as an ISO RECOMMENDATION.

ISO Recommendation | R 1463 | April 1970

# MEASUREMENT OF METAL AND OXIDE COATING THICKNESSES BY MICROSCOPICAL EXAMINATION OF CROSS-SECTIONS



## 1. SCOPE

This ISO Recommendation covers a method for the measurement of thickness of metal coatings, oxide layers and porcelain or vitreous enamels by microscopical examination of a cross-section.

At best this method will yield an absolute measuring accuracy of ± 0.8 μm; this will determine the suitability of the method for measuring the thickness of thin coatings.

## 2. SAMPLING

2.1 Specimens should be taken from one or more points on the significant surface*. They should be cut in such a way that the coating or oxide layer thickness is not altered.

2.2 To protect the edges of the specimen during preparation, soft coatings should be overplated to a thickness of not less than 10 μm with a harder deposit showing good contrast when etched.

## 3. MOUNTING

3.1 The specimen should be mounted to permit polishing of a section perpendicular to the surface where the coating or layer has to be measured**.

3.2 The specimen should be supported in a holder or mounting material in such a way that the temperature or pressure of the mounting operation does not significantly affect the thickness to be measured.

## 4. PREPARATION

4.1 The mounted specimen should be ground and polished for microscopical examination using the lowest pressure compatible with the hardness of the coating.

4.2 If the direction of grinding can be controlled, it should be from the harder to the softer material.

Grinding should be continued until any irregularity produced during the cutting operation is completely removed.

Grinding strokes should be angled at about 45° to the interface, the specimen being turned through 90° each time the abrasive is changed to a finer grade.

The ground surface should then be polished on a low speed wheel with suitable media.

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* *Significant surface* : the part of the surface which is essential to the appearance or serviceability of the article and which is to be covered by the coating.

When necessary, the significant surface should be the subject of agreement, and should be indicated on drawings, or by the provision of suitably marked samples.

** A deviation of 10° from the perpendicular will produce an apparent thickness about 2 % higher than the actual thickness.

## 5. ETCHING

5.1 To obtain maximum contrast between coating(s) and basis metal, it is advisable to etch the polished section even if the contrast after polishing is apparently sufficient. Furthermore, etching removes any trace of soft metal which may have been smeared over the harder metal during previous operations.

In the case of aluminium oxide coatings, etching is not necessary but may be used.

5.2 Some typical etchants are listed in the Appendix.

## 6. MEASUREMENT

6.1 Measurement of the coating or layer thickness may be made by one of the following methods :

(*a*) observation of the specimen on a metallurgical microscope using a calibrated micrometer eyepiece;

(*b*) projection of the specimen image onto the screen of a metallurgical microscope at an accurately determined magnification. The actual thickness of the coating is obtained by measuring the projected coating thickness and dividing it by the magnification factor.

6.2 The number and distribution of the measurements along the micrographic section should be decided in each individual case and stated in the report of the results.