



Standard Test Method for Surface Finger Oxide Penetration Depth and Presence of Interparticle Oxide Networks in Powder Forged (P/F) Steel Parts¹

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^{ε1} NOTE—Sections 1.1, 3.2, 5.1, 6.2, and 8.3 were editorially updated in January 2003.

1. Scope

1.1 This test method covers a metallographic method for determining the maximum depth of surface finger oxide penetration and the concentration of subsurface interparticle oxide networks in critical areas of powder forged steel parts.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Document

2.1 *ASTM Standards:*

E 3 Guide for Preparation of Metallographic Specimens²

3. Terminology

3.1 surface finger oxides—surface finger oxides are surface oxides that follow prior particle boundaries into a powder forged part from the surface and cannot be removed by physical means such as rotary tumbling. Examples of surface finger oxides are shown in Fig. 1.

3.2 interparticle oxide networks—interparticle oxide networks are continuous or discontinuous oxides that follow prior particle boundaries in powder forged parts. Examples of interparticle oxide networks are shown in Fig. 2.

4. Summary of Test Method

4.1 A section representing both surface and subsurface regions of a critical area is cut from the powder forged part and mounted for metallographic grinding and polishing.

4.2 For surface finger oxide penetration, the polished and unetched sample is examined microscopically at a magnification of 400×. The maximum depth of penetration of surface finger oxides is measured.

4.3 For interparticle oxide network concentration, the polished and unetched sample is examined microscopically at a magnification of 200 to 400× to determine the presence of interparticle oxide networks.

5. Significance and Use

5.1 The presence of surface finger oxide penetration and interparticle oxide networks are two of the properties used to evaluate powder forged steel parts for proper processing. Maximum acceptable depths of penetration of surface finger oxide penetration and acceptable concentrations of subsurface interparticle oxide networks depend on the component and its service environment.

5.2 Results of tests may be used to qualify parts for shipment.

6. Apparatus

6.1 Equipment for the metallographic preparation of test specimens.

6.2 A metallographic microscope permitting observation and measurement up to a magnification of 400×.

7. Sampling

7.1 A metallographic specimen shall be removed from the powder forged part to cover each designated critical area. Critical areas shall be defined by the applicable part drawing or the purchaser order. Specimens shall be taken from the powder forged part in the condition in which it is to be supplied. The polished surface of the specimens shall be parallel to the forging direction, that is, parallel to the direction of travel of the forging punch.

8. Procedure

8.1 *Preparation of Specimens*—In mounting the specimen for grinding and polishing, protection from rounding the edge of the part is essential. In polishing the specimen it is important that a clean polish be obtained and that edge detail of the part not be destroyed. Specimens shall be examined in the as-polished condition, free of the effects of any prior etching (if used). It is recommended that the procedures described in

¹ This test method is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.11 on Near Full Density Powder Metallurgy Materials.

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² *Annual Book of ASTM Standards*, Vol 03.01.