Designation: B 665 – 03

Standard Guide for Metallographic Sample Preparation of Cemented Tungsten Carbides[1]

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1. Scope

1.1 This guide prescribes a method for preparing cemented carbides for metallographic examination.

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 Documents

2.1 *ASTM Standards:*

B 390 Practice for Evaluating Apparent Grain Size and Distribution of Cemented Tungsten Carbides[2]

B 657 Test Method for Metallographic Determination of Microstructure in Cemented Tungsten Carbides[2]

3. Significance and Use

3.1 This sample preparation procedure may be used to prepare metallographic samples for Test Method B 657 and Practice B 390. It does not include all variations of sample preparation.

4. Selection of Specimen

4.1 Cemented tungsten carbides are very often in the form of relatively small pieces; it is possible to select and mount the entire piece in such manner as to permit examination of the entire cross section. When pieces are too large for this, however, they should be sectioned, using a diamond cutoff wheel, to allow viewing as much of a representative cross section as possible. For micrographs, the area selected should represent, as nearly as possible, the entire cross section.

5. Procedure

5.1 There are several acceptable methods for preparing cemented tungsten carbide surfaces for microscopical examination. Basically, they all use diamond wheels for grinding and diamond powders for lapping. The grinding practices differ, to a minor degree, with respect to grit size of diamond. In all practices, however, the final polish is produced by extremely fine diamond powder lapping, and in all practices care must be exercised to retain the microstructure in its true form and to avoid pull-out of the softer matrix material (usually cobalt). While it is accepted that other procedures may be used successfully, this procedure has proved satisfactory in many laboratories.

5.1.1 *Mounting*—Where possible, specimens should be mounted in a plastic material such as phenol-formaldehyde or poly(methyl methacrylate) to facilitate polishing without rounding the edges. Larger specimens may be polished without mounting. When specimens are too large they may be sectioned using a diamond cut-off wheel or they may be fractured (appropriate safety precautions should be used when fracturing specimens). The area selected for examination should represent, as nearly as possible, the entire cross section.

5.1.2 *Rough Grinding*—The surface to be examined may be ground flat on a surface grinder with a resin-bonded diamond wheel (100 to 220 grit) operated at 5000 to 5500 surface feet per minute (25 to 28 m/s). After the surface is flat, several clean-up passes are required; the maximum depth of cut should be 0.0005 in. (13 µm) per pass and copious amounts of coolant should be used.

5.1.3 *Polishing*—Polishing in three steps using diamond powder or paste on a synthetic short-napped cloth (the reverse side of photographic paper, or manila file folders may also be used). When automatic polishing equipment is used, a resin-bonded diamond disk may be substituted in the roughing lap. For manual polishing, speeds of 500 to 600 rpm should be used; automatic polishing generally requires speeds of 100 to 200 rpm.

5.1.3.1 *Roughing Lap*—For the roughing lap, use NIST Grade 20 diamond powder[3] (15 to 25 µm) dispersed in light spindle oil. Commercial diamond paste and thinner will provide similar results.

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[1] This guide is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Productsand is the direct responsibility of Subcommittee B09.06 on Cemented Carbides.

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[2] *Annual Book of ASTM Standards*, Vol 02.05.

[3] Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 3460, Gaithersburg, MD 20899-3460.

5.1.3.2 *Second Lap*—For the second lap, use Grade 6 diamond powder (4 to 8 µm) or an equivalent paste.

5.1.3.3 *Finishing Lap*—For the finish lap, use Grade 1 diamond powder (less than 2 µm) or an equivalent paste.

NOTE 1—Best results are obtained by applying considerable pressure to the specimen in all lapping operations. Lack of adequate pressure will result in pulling out the softer matrix material. It is also essential that the specimen and operator's hands be thoroughly cleaned between all grinding or polishing steps; ultrasonic cleaning is recommended.

6. Precision and Bias

6.1 The nature of this guide precludes any statement of precision and bias.

7. Keywords

7.1 cemented carbides; cemented tungsten carbides; microstructure