Designation: F 1978 – 99

Standard Test Method for Measuring Abrasion Resistance of Metallic Thermal Spray Coatings by Using the Taber™ Abraser[1]

This standard is issued under the fixed designation F 1978; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method quantifies the abrasion resistance of metallic coatings produced by thermal spray processes on flat metallic surfaces. It is intended as a means of characterizing coatings used on surgical implants.

1.2 This test uses the Taber™[2] abraser, which generates a combination of rolling and rubbing to cause wear to the coating surface. Wear is quantified as cumulative mass loss.

1.3 This test method is limited to flat, rigid specimens that do not react significantly with water and do not undergo a phase transformation or chemical reaction between room temperature and 100°C in air.

1.4 *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 applicable regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *abraser*, *n*—an instrument that is designed to determine the resistance of surfaces to composite rolling and rubbing action.

3.1.2 *particle shedding*, *n*—the loss of surface particles and fragments from a coating.

3.1.3 *thermal spray coating*, *n*—coating produced by spraying melted or softened powder or wire by means of combustible gases, plasma, or two-wire arc.

3.1.4 *weight loss*, *n*—amount of mass removed by the test apparatus over the course of testing.

4. Summary of Test Method

4.1 This test method uses a Taber™ abraser with H-22 Calibrade™ wheels[2] and the 250-g mass of the abrading head without added weights. Specimens are abraded repeatedly and cleaned ultrasonically for a set number of rotational cycles (2 to 100 cycles). The specimens are weighed after each cleaning, and the mass loss is the measure of abrasive wear to the specimen.

5. Significance and Use

5.1 This test method provides a means to evaluate the resistance to particle shedding of a thermal sprayed coating. Such particle shedding might occur during surgical insertion of an implant or as the result of micromotion of the implant after surgical insertion.

5.2 This abrasion test method may be useful for quality control analysis of a coating, and it can be used to evaluate the effects of processing variables, such as substrate preparation prior to coating, surface texture, coating technique variables, or post-coating treatments, any of which may influence the susceptibility of the coating to particle shedding.

5.3 This abrasion test method is for flat plate shaped specimens of a size sufficient that the wheels of the abrader do not leave the surface of the specimen. It is not recommended, however, for devices with other shapes or sizes.

6. Apparatus

6.1 *Taber™ Abraser Model 5150*, or equivalent.

6.2 *Two H-22 Taber™ Calibrade™ Wheels*, or equivalent, with abrading head of 250-g mass and no added weights.

6.3 *Taber™ Vacuum Unit*, made by Shop-Vac™,[2] 7.4 amps, or equivalent.

6.4 *Taber™ Wheel Refacer Model 200*[2].

6.5 *Ultrasonic Cleaning Unit*, for cleaning specimens after abrading.

6.6 *Drying Oven*, capable of operation at 100°C ± 2°C, for drying specimens.

6.7 *Analytical Balance*, capable of weighing specimens to an accuracy of 0.0001 g.

7. Test Specimen

7.1 Abrasion test specimens shall be 10-cm (4-in.) squares or 10-cm diameter circles of at least 0.16-cm (0.0625-in.) thickness with a 0.64-cm (.25-in.) diameter hole through the

[1] This test method is under the jurisdiction of ASTM Committee F-04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.15 on Material Test Methods.

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[2] The sole source of supply of the apparatus known to the committee at this time is Taber Industries, North Tonawanda, NY 14120 USA. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

[3] *Annual Book of ASTM Standards*, Vol 14.02.