



Standard Specification for Electrodeposited Coatings of Palladium- Cobalt Alloy for Engineering Use¹

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1. Scope

1.1 This specification covers requirements for electrodeposited palladium-cobalt alloy coatings containing approximately 80% of palladium and 20% of cobalt. Composite coatings consisting of palladium-cobalt with a thin gold overplate for applications involving electrical contacts are also covered. Palladium and palladium-cobalt remain competitive finishes for high reliability applications.

1.2 *Properties*—Palladium is the lightest and least noble of the platinum group metals (1)². It has the density of 12 gm per cubic centimeter, specific gravity of 12.0, that is substantially lower than the density of gold, 19.29 gm per cubic centimeter, specific gravity 19.3, and platinum 21.48 gm per cubic centimeter, specific gravity 21.5. The density of cobalt on the other hand is even less than palladium. It is only 8.69 gm per cubic centimeter, specific gravity 8.7. This yields a greater volume or thickness of coating and, consequently, some saving of metal weight and reduced cost. Palladium-cobalt coated surface provides a hard surface finish (ASTM E18) thus decreasing wear and increasing durability. Palladium-cobalt coated surface also has very low coefficient of friction 0.43 compared to hard gold 0.60 thus providing lower mating and unmating forces for electrical contacts (1)². Palladium-cobalt has smaller grain size (ASTM E112), 50 – 150 Angstroms, compared to Hard Gold 200 – 250 Angstroms (1)². 5 – 15 nanometer, compared to hard gold 20 – 25 nanometer (1)². Palladium-cobalt has low porosity (ASTM B799) 0.2 porosity index compared to hard gold 3.7 porosity index (1)². Palladium-cobalt coated surface has higher ductility (ASTM B489) 3-7 than that of hard gold <3 (1)². The palladium-cobalt coated surface is also thermally more stable 395°C than hard gold 150°C, and silver 170°C. The following Table 1 compares the hardness range of electrodeposited palladium-cobalt with other electrodeposited noble metals and alloys (3,4).²

¹ This specification is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.04 on Precious Metal Coatings.

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² The boldface numbers in parentheses refer to the list of references at the end of this specification.

TABLE 1 - Hardness of Noble Metals

	Approximate Hardness (HK ₂₅)
Gold	50–250
Palladium	75–600
Platinum	150–550
Palladium-Nickel	300–650
Palladium-Cobalt	500–650
Rhodium	750–1100
Ruthenium	600–1300

1.3 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 applicability of regulatory limitations prior to use. Some specific hazards statements are given in Section 7 on Hazards.*

2. Referenced Documents

2.1 ASTM Standards:³

- B183 Practice for Preparation of Low-Carbon Steel for Electroplating
- B242 Guide for Preparation of High-Carbon Steel for Electroplating
- B254 Practice for Preparation of and Electroplating on Stainless Steel
- B281 Practice for Preparation of Copper and Copper-Base Alloys for Electroplating and Conversion Coatings
- B322 Guide for Cleaning Metals Prior to Electroplating
- B343 Practice for Preparation of Nickel for Electroplating with Nickel
- B374 Terminology Relating to Electroplating
- B481 Practice for Preparation of Titanium and Titanium Alloys for Electroplating
- B482 Practice for Preparation of Tungsten and Tungsten Alloys for Electroplating
- B487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.