Designation: ~~B849 – 02 (Reapproved 2013)~~ B849 – 02 (Reapproved 2019)

Standard Specification for Pre-Treatments of Iron or Steel for Reducing Risk of Hydrogen Embrittlement[1]

This standard is issued under the fixed designation B849; 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.

INTRODUCTION

When atomic hydrogen enters steels and certain other metals, for example, aluminum and titanium alloys, it can cause a loss of ductility, load carrying ability, or cracking (usually as submicroscopic cracks) as well as catastrophic brittle failures at applied stresses well below the yield strength or even the normal design strength for the alloys. This phenomenon often occurs in alloys that show no significant loss in ductility, when measured by conventional tensile tests, and is referred to frequently as hydrogen-induced delayed brittle failure, hydrogen stress cracking, or hydrogen embrittlement. The hydrogen can be introduced during cleaning, pickling, phosphating, electroplating, autocatalytic processes, porcelain enameling, and in the service environment as a result of cathodic protection reactions or corrosion reactions. Hydrogen can also be introduced during fabrication, for example, during roll forming, machining, and drilling, due to the breakdown of unsuitable lubricants as well as during welding or brazing operations. Parts that have been machined, ground, cold-formed, or cold-straightened subsequent to hardening heat treatment are especially susceptible to hydrogen embrittlement damage.

The results of research work indicate that the susceptibility of any material to hydrogen embrittlement in a given test is related directly to its trap population. The time-temperature relationship of the heat treatment is therefore dependent on the composition and structure of steels as well as plating metals and plating procedures. Additionally, for most high-strength steels, the effectiveness of the heat treatment falls off rapidly with a reduction of time and temperature.

1. Scope

1.1 This specification covers procedures for reducing the susceptibility or degree of susceptibility to hydrogen embrittlement or degradation that may arise in electroplating, autocatalytic plating, porcelain enameling, chemical conversion coating, and phosphating and the associated pretreatment processes. This specification is applicable to those steels whose properties are not affected adversely by baking at 190 to ~~230°C~~230 °C or higher (see 6.1.1).

1.2 The heat treatment procedures established herein have been shown to be effective for reducing the susceptibility of steel parts of tensile strength 1000 MPa or greater that have been machined, ground, cold-formed, or cold-straightened subsequent to heat treatment. This heat-treatment procedure is used prior to any operation capable of hydrogen charging the parts, such as the cleaning procedures prior to electroplating, autocatalytic plating, porcelain enameling, and other chemical coating operations.

NOTE 1—1 MPa = 145.1 psi.

1.3 This specification has been coordinated with ISO/DIS 9587 and is technically equivalent.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

[1] This specification is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.02 on Pre Treatment.

Current edition approved ~~May 1, 2013~~April 1, 2019. Published ~~May 2013~~April 2019. Originally approved in 1994. Last previous edition approved in ~~2007~~2013 as B849 – 02 ~~(2007).~~(2013). DOI: ~~10.1520/B0849-02R13.~~10.1520/B0849-02R19.