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Recommended Methods for Conducting Corrosion Tests in Gasoline/Methanol Fuel Mixtures

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RECOMMENDED METHODS FOR CONDUCTING CORROSION TESTS IN GASOLINE/METHANOL FUEL MIXTURES

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RECOMMENDED METHODS FOR CONDUCTING CORROSION TESTS IN GASOLINE/METHANOL FUEL MIXTURES

In 1989 an Oxygenated Fuels Task Force comprised of Chrysler, Ford, and General Motors automotive engineering executives, operating in accordance with the 1984 Cooperative Research Act, was formed to address the many issues related to the use of oxygenated fuels in automotive applications. Project Group 2, one of four committees formed by the Task Force to address those issues, was charged with reviewing and developing materials test methods and evaluating materials for use in methanol-gasoline fuel blends. To this end, Project Group 2 (see Appendix 2) developed and published "Gasoline/Methanol Mixtures for Materials Testing."

INTRODUCTION

The Problem

Corrosion testing of metals has a long and varied history. In spite of the problems inherent in extrapolating results in accelerated tests on standard specimens to actual field durability, engineers have been able, to a large extent, to rely on these results in making materials selection decisions. However, these tests have employed aqueous media and are not strictly applicable to the use of organic chemical media. With methanol-gasoline fuel blends and their high electrical conductivity relative to gasoline, one has lost the relevance of the historical database. Therefore, to allow rapid build-up of a new database, some corrosion test procedures have been reviewed and amended where appropriate.

The Approach

The change in medium has required some modifications in both the equipment and the way of carrying out the tests. In some areas, e.g., open or closed containers or test temperature, compromises had to be accepted. These most often involved the trade-offs among higher temperature (for greater acceleration of results), oxygen concentration (faster reaction, but less soluble at high temperature), media volatility (methanol b.p. 64°C), and the possibility of phase separation in the fuel to produce a methanol-water rich layer. It is expected that results obtained using the modified procedures can be used to produce valid comparative rankings of materials.



How to Interpret the Document

Each of the following sections addresses a single corrosion test or practice. For brevity's sake, only those parts of the original procedure which are affected by the change in exposure medium are given. The individual sections cannot stand alone but must be used in conjunction with the referenced document. The most extensive revision involved the most far reaching procedure, namely, ASTM G31. Consequently, instead of being repeated, the changes made in this practice have been only referenced in the other methods.



Section 1 -- Standard Practice for Laboratory Immersion Corrosion Testing of Metals in Methanol Fuels

This document describes the specific test conditions and requirements for immersion corrosion testing of metals, inorganic coated metals, and plated metals in methanol fuels within the general procedure described in ASTM G31-72¹.

Interferences

Paragraph 4.1.3 of ASTM G31, concerning the aeration of the solution, is to be excluded for testing in methanol fuels. Aeration or deaeration is not to be used as part of this procedure.

The methanol fuel test solution is to be changed once each week of the test in order to minimize bulk solution composition changes, minimize oxygen depletion of the fuel, and to replenish ionic contaminants (paragraph 4.1.4).

Apparatus

A closed, air tight, 1000 mL high-density polyethylene container with a minimum burst strength of 2 atm. is required. The vessel is not to be filled to more than 80% of its volume. No metallic vessels are permitted.

Typically, the container is to be heated by air or in a water or sand bath. No heating mantles or hot plates are permitted. The vessel is to be heated uniformly with no localized application of heat. No aeration or stirring of the solution is allowed. Observe safety precautions applicable to the handling of flammable mixtures (refer to OSHA Laboratory Standards).

The temperature must be maintained at 45°C +/- 2° for the duration of the test.

¹This Standard involves hazardous materials. Methanol is a flammable liquid that burns with a low visible flame. It is toxic by ingestion or skin contact. Explosion proof heaters and other equipment should be used. It is the responsibility of the user of this standard to comply with all Federal and State Safety Regulations and to establish the appropriate safety and health practices.