



# **Test Methods for Evaluating Material Compatibility in Compressed Hydrogen Applications - Polymer**

GTR no. 13 Phase 2 IWG

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Representing: CSA CHMC 2 committee



ANSI/CSA CHMC 2-2018

Test methods for evaluating material compatibility in compressed hydrogen applications - **Polymers**



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## Title

*CHMC 2 – Test Methods for Evaluating Material Compatibility in Compressed Hydrogen Applications – **Polymers***

## Scope

*This standard provides **uniform test methods** for evaluating material compatibility with compressed hydrogen applications. **The results of these tests are intended to provide a basic comparison of materials** performance in applications utilizing compressed hydrogen. This standard is not intended to replace sound engineering judgment; additional testing considerations may be necessary to fully qualify the design of a component manufactured for use in certain hydrogen applications.*

*This standard applies to polymer materials only.*

- ✓ **STEP 1:** Agree to high priority tests for polymer compatibility in hydrogen
- ✓ **STEP 2:** Develop high priority test methods for CHMC 2
  - » Assign sub-group with expertise to formulate method (may vary per application)
  - » Identify existing standards for high priority tests
  - » Evaluate if existing are sufficient to reference
  - » Provide test method recommendation to full committee
- **STEP 3:** Insert test methods into document and complete supporting sections
  - » Review test methods by full committee
  - » Determine additional material considerations and rating scale
  - » Develop other sections in the document (see CHMC 1 structure)
  - » Prepare document for public review & ballot

We have a draft CHMC 2 document and refining the content

# CHMC 2 – STEP 1: Agree to high priority tests



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Test methods for evaluating material compatibility in compressed hydrogen applications - **Polymers**

## Contents

- 0. Introduction
- 1. Scope
- 2. Reference Publications
- 3. Definitions
- 4. General Requirements
- 5. Test Methods
- 6. Material Qualifications
- Annex

We have the polymer compatibility tests identified per industry and FMEA input

### **5 Test Methods**

**5.1 Hydrogen Diffusion and Permeability**

**5.2 Physical Stability**

**5.3 Material Property Changes**

**5.4 Dynamic Wear**

**5.5 Material Contamination**

**5.6 Hydrogen Exposure, Cycling, and Aging**

# CHMC 2 – STEP 2: Develop high priority test methods



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## Test methods for evaluating material compatibility in compressed hydrogen applications - **Polymers**



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### CHMC 2 Test Method

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#### 1.1 Apparatus

→ Describe test equ

#### 1.2 Test environm

→ Describe pressur

#### 1.3 Specimen Prep

→ Describe test sam

#### 1.4 Test Procedure

→ Describe test step

#### 1.5 Reporting

→ Describe test rest

### CHMC 2 Test Method: Physical Stability of Polymers in Hydrogen Environments Density or Specific Gravity Measurements of Polymers

#### Test Purpose

This test method gives the details of the procedure to evaluate the density changes of specimens of elastomeric or solid polymeric materials due to swelling or shrinking upon exposure to hydrogen environments. Dimensional and density measurements will be made prior to and after conditioning in the designated test gas (in this case hydrogen).

#### 1.1 Apparatus

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Component
Hydrogen
CO + CO <sub>2</sub>
Nitrogen
Oxygen
THC
Water

Table 1. Comp

### CHMC 2 Test Method: Physical Stability of Polymers in Hydrogen Environments

#### Test Purpose

This test method gives the details of the procedure to evaluate the change in dimensions and mass of specimens of elastomeric or rubbery materials due to swelling or shrinking upon exposure to hydrogen environments. Dimensional and mass measurements will be made prior to and after conditioning in the designated test gas.

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Hydrogen
CO + CO <sub>2</sub>
Nitrogen
Oxygen
THC
Water

Table 1. Com

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#### 1.3 Specimen Pr

The following

We have test methods developed for each polymer compatibility test

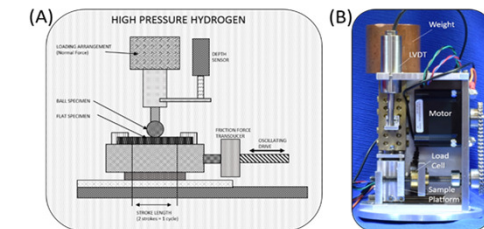


Figure 1. (A) Schematic of the in situ tribometer to measure friction and wear in a high-pressure hydrogen environment.

# CHMC 2 – Development Schedule Status



	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Committee Meeting (4 <sup>th</sup> Wednesday of Month)	X	X		X	X X	X	X	X	X	X		
<b>STEP 2: Test Methods</b> - Working Group Effort	█											
Prepare support sections - Chair / CSA Effort	█											
<b>STEP 3: Merge Content</b> - Full committee review				█								
CHMC 2 CSA DOC PREP - internal quality review (2 wks) - editorial team review (2 wks)								█				
PUBLIC REVIEW									█			
EDITING per comments										█		
BALLOT											█	
BALLOT DISPOSITION												█



We are on-track for document ballot by the end of the year

If interested in participating or further information, please contact: Mike Veenstra [mveenstr@ford.com](mailto:mveenstr@ford.com)