Technical Report

ISO/TR 20470-1

First edition
2026-03

New weatherable topcoats as part of an associated protective coating system —

Part 1: Weathering of FEVE type fluoropolymer topcoat

Nouvelles couches de finition résistantes aux intempéries faisant partie d'un système de revêtement protecteur associé —

Partie 1: Vieillissement aux intempéries de la couche de finition en fluoropolymère de type FEVE

Reference number
ISO/TR 20470-1:2026(en)

© ISO 2026



COPYRIGHT PROTECTED DOCUMENT

© ISO 2026

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 General introduction of FEVE type fluoropolymer **2**
4.1 Chemical structure of FEVE type fluoropolymer 2
4.2 Chemical curing system 2
5 Weatherability of fluoropolymer topcoats **3**
5.1 Weatherability by fluorescent UV condensation cycle testing 3
5.2 Fifteen years weatherability test of FEVE type fluoropolymer topcoats 4
5.3 Actual bridges situation 6
6 Durability of fluoropolymer topcoat system **6**
6.1 Results of collaboration study 6
6.2 Evaluation of the durability 9
6.2.1 Weatherability test during 29 years of fluoropolymer topcoat system 9
6.2.2 Test method 9
6.3 Summary 12
7 Health and safety **12**
Annex A (informative) **Examples of bridges with FEVE type fluoropolymer topcoat systems** **13**
Bibliography **16**

© ISO 2026 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 14, *Protective paint systems for steel structures*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© ISO 2026 – All rights reserved

Introduction

In ISO 12944-5:2019, 6.2.5, fluoroethylene vinyl ether (FEVE) fluoropolymer topcoats are characterized as a specialized type of polyurethane based on fluoropolymers. This document describes the characteristics of the fluoropolymer topcoats with the intention of helping users understand both their advantages and limitations. Joint research on enhancing the weatherability and durability for a variety of coatings was launched in 1983 managed by the Public Works Research Institute of the Ministry of Construction in Japan and was continued until the publication of this document. The fluoropolymer topcoat systems were included in the joint research and results were obtained on the durability and weatherability over 30 years. These fluoropolymer topcoats systems were reported at several international conferences.[1]-[9] This document incorporates valuable findings from the joint research on weathering tests conducted over the past 30 years, which are beneficial for users. Moreover, users are encouraged to contribute their own results to enhance the comprehensiveness of this document. FEVE type waterborne fluoropolymer topcoats and their coating systems have been developed and used in the market since around 2015, but long-term outdoor weathering data as has been obtained for the solvent borne type have not been achieved at present.

This document contains weathering performance data such as the rate of gloss retention and chalking resulting in film thickness loss of the topcoat system, along with chemical analysis data focusing on the coating film deterioration of fluoropolymer topcoat. All data has been obtained from the outdoor exposure testing. The chemical analysis relating to coating film deterioration was conducted using FTIR spectroscopy, covering analysis of both the surface and the cross-section (depth direction from the surface).

Users of this document can use the results of the long-term outdoor exposure test to predict the durability of the coating system.

Finally, this document points to the technological development of coating materials with state-of-the-art weathering performance in future, such as extremely slow chalking deterioration. This coating can be the standard reference for observing and evaluating short-, medium- and long- term weatherable coatings using the outdoor exposure data of these topcoats.

By using the data in this document, the real time durability of the coating film can be efficiently estimated using a short-term exposure test or an accelerated weathering test, or both.

© ISO 2026 – All rights reserved

New weatherable topcoats as part of an associated protective coating system —

Part 1:
Weathering of FEVE type fluoropolymer topcoat

1 Scope

This document describes the basic characteristics of fluoroethylene vinyl ether copolymer (FEVE) type fluoropolymer topcoats and their coating systems. Information on the weathering performance of the fluoropolymer topcoats and associated coating systems for over 30 years is also provided.[1],[4]-[12]

This document covers:

— weathering data of FT (FEVE fluoropolymer topcoat);

— chemical analysis of outdoor exposed coated panels focusing on the paint surface and their cross-sections.

This document does not include FEVE type waterborne fluoropolymer topcoats and their coating systems.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
imaging infrared
imaging IR
method of measuring and imaging the in-plane distribution of functional groups specific to a compound using a detector composed of multiple elements

Note 1 to entry: Since it is possible to measure the molecular structure over a wide area, imaging IR is effective for investigating the cross-sectional structure of surface deterioration due to ultraviolet irradiation and the cross-sectional layer structure of multilayer films.

3.2
fluoroethylene vinyl ether copolymer
FEVE
resin which consist of fluoro-olefin units, various hydrocarbon vinyl ether units and has pendant OH-groups

Note 1 to entry: Along the polymer chain each vinyl ether unit alternates with fluoro-olefine unit. This sequence is responsible for weather resistance.

© ISO 2026 – All rights reserved