PERFORMANCE FLUOROPOLYMER PARTNERSHIP

September 24, 2023

Re: Comments for the REACH Annex XV All PFAS Restriction Proposal

Submitted via the European Chemicals Agency's webform at https://comments.echa.europa.eu/comments_cms/AnnexXVRestrictionDossier.aspx?RObjectId=0b0236e1885e69de

The American Chemistry Council's (ACC) Performance Fluoropolymer Partnership (hereafter "PFP") welcomes the opportunity to respond to the call for comments to the Annex XV restriction report with respect to market and end-use segments not covered in the report. The PFP's members are some of the world's leading manufacturers, processors and users of fluoropolymers, including fluoroplastics, fluoroelastomers and perfluoropolyethers polymers.

These comments are a supplement to the comments provided earlier on the use of fluoropolymers (fluoroplastics) in Infrastructure and Construction (I&C) applications (August 27, 2023; Reference number 3eb5e616-f855-4393-abbc-e1eeb7c25ff4). This is a commercial/industrial application/use segment with little to no direct consumer use. This end-use was not called out for special consideration in the EU Restriction Report and therefore would be subject to a full ban at 18 months after entry into force. Specifically, these comments provide additional data and information on the performance of fluoropolymer-based coatings for solar panels.

Thank you for the opportunity to provide these comments. Please contact me if you or your colleagues have any questions.

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Executive Director
Performance Fluoropolymer Partnership

Solar Panels

Products Used: ETFE; PVDF; Zeffle®; FEVE; PVF

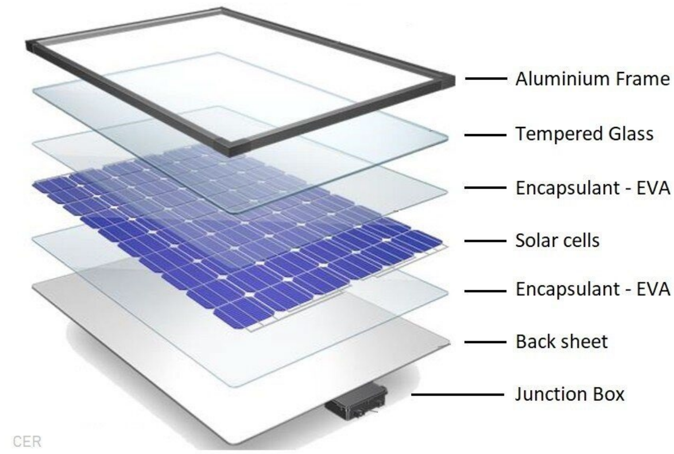
Fluoropolymers are often used as back sheets (films) in photovoltaic solar panel construction (**Figure 31**). Materials used in this end-use should have significant UV resistance and stability, corrosion resistance and flexibility. Fluoropolymers are light in weight and have extended durability in full exposure to a variety of environmental conditions, including intense sunlight and heat. Other materials used in back sheet applications are polyamides, polyethylene terephthalate (PET), glass and polyesters. A number of studies have been conducted to evaluate these materials and viable alternatives. (DuPont PV Study, 2020; OECD, 2022; GSPI, 2021)

Numerous uses of fluoropolymers are documented in solar panel manufacture and use. Fluoropolymer coatings or films may be incorporated into the glass top layer of panels, the encapsulant film that surrounds the solar cells and the back sheet. Fluoropolymers reportedly increase durability, transparency, UV-resistance, heat-resistance, mechanical strength, dirt-repellency and energy production, and they are lightweight. Halar® (ECTFE), Tefzel® (ETFE) and Lumiflon® (FEVE), as well as polyvinyl fluoride (PVF) and PVDF, are among the fluoropolymers used for solar panels. (GSPI, 2021; AGC, 2021)

Back sheets are used on solar panels to help protect the solar cell from weather, humidity, loads, and impact damage. It has also been noted that they also help provide electrical isolation for safety purposes. The proper choice of the back sheet can increase the panel life and reduce the cost of electricity generated from the panel over the solar panel cell's life. Requirements for the back sheet include opacity and high reflectivity.

Back sheets as shown in **Figure 31** are typically laminates often consisting of PVF, PET and poly (ethyhlene-vinyl acetate) (EVA or PEVA) films. For example, PET films are used in applications where increased UV stability is desirable. These applications include back sheets on solar panels as well as architectural and automotive protective films. It should be noted that PET will degrade over time reducing its ability to protect the desired substrate. PVF and Lumiflon® FEVE have been used as a weather resistant topcoat layer that helps protects the PET and EVA from degradation, especially from UV light.

Figure 31. The 6 main components used in the construction of a solar panel



From: https://www.cleanenergyreviews.info/blog/solar-panel-components-construction

To demonstrate the benefits of the fluoropolymer coating on the non-fluorinated film layer, two examples are provided below for illustrative purposes. The first is a xenon arc accelerated weathering test. In this test, the FEVE polymer-coated PET film was subjected to 3,000 hours in a weatherometer, a device used to evaluate UV aging. The results were compared to the uncoated PET film and the Color change (ΔE) was measured. Results are shown below in **Figure 32**. After 3,000 hours, the PET film coated with the FEVE-based topcoat shows no change in color, while the uncoated film has a visible decline in appearance.

Figure 32. Xenon Arc Weatherometer Test Results of FEVE-coated and Uncoated PET Film

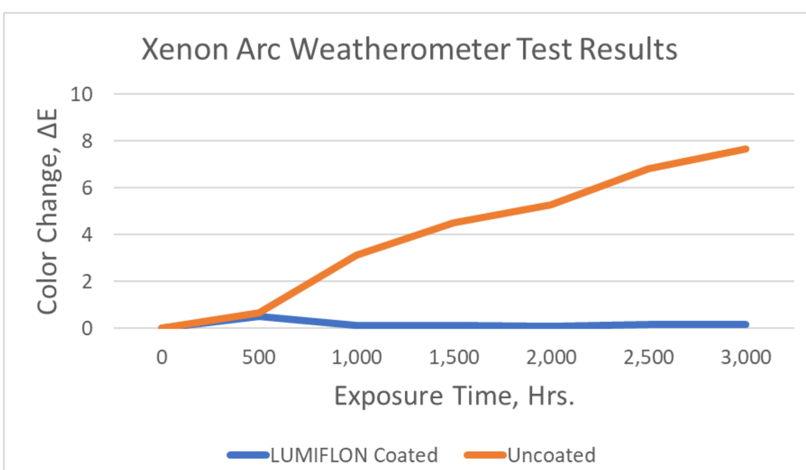


Figure with permission of AGC.

In the second test to evaluate UV stability of the Lumiflon® FEVE-based fluorourethane coating compared to that of PVF-based coating, panels were placed in the Xenon Arc Weatherometer for 5,000 hours. When color change of polymers is measured, B* is an indicator of yellowing. B* was monitored over the duration of the test; results are shown in **Figure 33** below.

Figure 33: Xenon Arc Weatherometer Test of PVF and FEVE Laminate Films

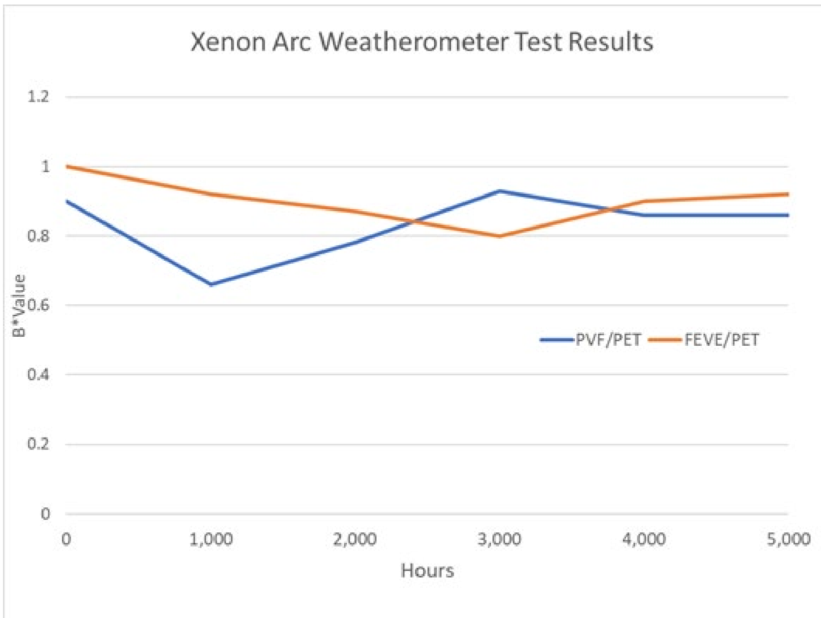


Figure with permission of AGC.

Both the FEVE-based fluorourethane coating and the PVF-based topcoat film performed extremely well in this test by preventing yellowing of the PET film over the 5,000-hour duration of the test (Madico, Inc., 2013).

Reference not Included in Earlier Submission

Madico, Inc., 2013. Backing sheet for photovoltaic modules. M. Temchenko. D.W. Avison, F.A. Mannarino and S. Lim. US Patent 8507029B2., August 13, 2013.