



ENHANCING PVC BUILDING MATERIALS  
WITH TI-PURE™ TITANIUM DIOXIDE:

## **A Focus on Durability and Longevity**



Now, more than ever, I see the multi-dimensional challenges the plastics industry faces. These headwinds include an urgency to address pressures raised regarding the value, use, and management of plastic materials.

One thing is clear, within these challenges lies a significant opportunity for positive transformation. This is where those in the polyvinyl chloride (PVC) industry serving building materials have taken a forward-thinking approach to advancement.

At Chemours, our Ti-Pure™ titanium dioxide (TiO<sub>2</sub>) team sees further possibilities to speed up our progress and, together with others in the PVC industry, deliver value and improved building materials to meet the needs of our evolving market. By focusing on enhancing durability, longevity, and aesthetic appeal, Ti-Pure™ TiO<sub>2</sub> by Chemours empowers the creation of resilient and sustainable structures that can withstand the test of time.



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## Introduction

The building and construction sector faces the constant challenge to balance the requirements of building designs while keeping related materials costs manageable. More recently, an expanded holistic view of building materials has emphasized the importance for materials selections that will endure over time while requiring minimal upkeep.

Regarding construction materials, PVC has emerged as a material of choice for applications including facades, profiles, and membranes, with advantages ranging from barrier properties to visual appeal. Integrating titanium dioxide into PVC formulations enables a significant enhancement to the durability and performance of these materials.

This white paper explores the transformative impact that Ti-Pure™ TiO<sub>2</sub> delivers to PVC material performance for the durability and longevity desired to meet the multifaceted needs of modern construction.



## THE IMPORTANCE OF DURABLE BUILDING MATERIALS

The quest to find building materials that are both long-lasting and resilient is critical. Using durable materials is essential for building development as they reduce the need for frequent repairs and replacement, leading to cost savings. In some cases, these materials also offer further benefits, such as improving building maintenance efficiency, resulting in fewer material replacements and repairs, thus providing better resource management.<sup>1</sup>

The global building and construction plastics market had a value of \$130.16 billion in 2021. It's expected to reach \$239.29 billion by 2030, growing at a CAGR of 7% during the forecast period of 2022 to 2030. The PVC segment is the highest contributor to the market and is expected to grow at a CAGR of 4.3% during the forecast period.<sup>2</sup>

The search for optimal building materials delivering on these diverse requirements has sparked innovation such as the use of specialized Ti-Pure™

TiO<sub>2</sub> by Chemours into PVC products. With these advancements, the use of PVC in construction has expanded with enhancement of durability, lifespan, and aesthetic appearance. By strengthening PVC against environmental stressors and degradation, TiO<sub>2</sub> enables the use in building structures that can withstand time and weather challenges, promoting a more sustainable and cost-effective approach to construction.

Equally pressing to our global community is the concern of greenhouse gas emissions, which are dominated globally by the built environment sector which contributing 37% of emissions.<sup>3</sup> Historically, addressing the emissions has taken the focus primarily on reducing a building's operational carbon emissions, but there is a critical need to further decrease the "embodied carbon" emissions from the design, production, and deployment of building materials – particularly those with longer service lives.



## THE ROLE OF PVC IN MODERN CONSTRUCTION

PVC is often referred to as the “go-to plastic” for infrastructure projects. It’s easy to see why. The construction sector alone accounts for 70% of PVC production thanks to its cost-effective properties.<sup>4</sup>

Used extensively in construction applications, PVC offers a budget friendly choice for builders. It serves a range of purposes, from window frames to flexible roofing materials, providing both durability and aesthetic appeal for property owners.

Despite its advantages in construction projects, PVC has its downsides. One notable concern is its susceptibility to damage from prolonged exposure to sunlight and the associated ultraviolet (UV) rays.

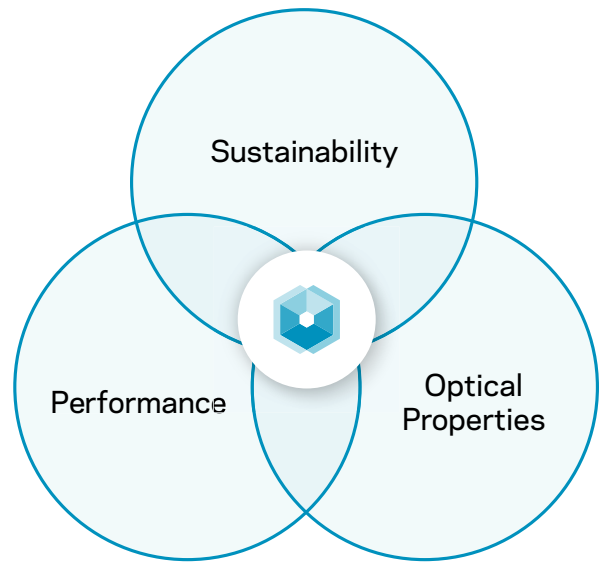
Prolonged UV exposure can lead to color changes, increased brittleness, and the formation of cracks in the PVC material. This not only affects the PVC’s appearance but also jeopardizes its structural integrity, putting it at risk of premature mechanical failure and expensive repairs.

Furthermore, certain pigments, particularly those that are colored, used in PVC products absorb heat from the sunlight spectrum, activating and accelerating their deterioration and thus reducing their lifespan. Further, heat absorption can contribute to increased energy consumption in buildings by necessitating cooling efforts to maintain a comfortable indoor environment.



# The Benefits of Adding Titanium Dioxide to PVC

Our proprietary research shows that the addition of Ti-Pure™ TiO<sub>2</sub> pigments to PVC materials offers improvements that greatly enhance the appeal of PVC in construction. By maintaining material strength, prolonging lifespan by reducing brittleness and breakage, guarding against UV degradation, reflecting heat, and maintaining aesthetic appeal, TiO<sub>2</sub> serves as a protectant against time and weather. These qualities result in advantages for construction professionals and consumers alike, supporting sustainability and affordability.



## ENHANCING DURABILITY

The primary benefit of incorporating Ti-Pure™ TiO<sub>2</sub> by Chemours into PVC is the improvement of durability. Specially designed titanium dioxide helps protect PVC products from the damaging effects of UV radiation. Incorporating Ti-Pure™ TiO<sub>2</sub> into PVC enhances durability by shielding the PVC materials from chemical degradation. This prevents yellowing, brittleness, and cracking, ensuring that PVC products maintain their structural integrity and aesthetic appeal over extended periods.

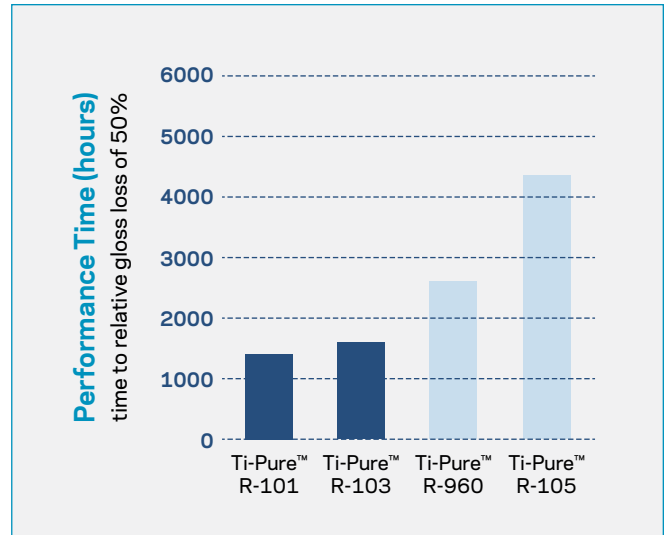


## INCREASING LONGEVITY

Ti-Pure™ TiO<sub>2</sub> also contributes to the longevity of PVC materials. By preventing degradation, Ti-Pure™ TiO<sub>2</sub> ensures that PVC products maintain both their visual appearance and mechanical integrity, reducing the need and frequency of replacements. This extended durability translates into cost savings for building owners and homeowners with less disruption because of maintenance or material failure.

As an example, when PVC comprises Ti-Pure™ TiO<sub>2</sub>, the beneficial impact is clear as it can deliver <sup>5</sup>:

- Longer service life
- Light reflection yielding reduced peak electricity demand and cooling load
- Management of the temperature of Urban Heat Island
- The ability to recycle materials at the end of life



The performance time data of PVC parts comprising Ti-Pure™ TiO<sub>2</sub> materials and additive packages typical for NA exterior PVC demonstrates how PVC parts exposed to exterior weathering simulation with TiO<sub>2</sub> grades specially designed for durability and longevity (R-960 and R-105) deliver extended performance time.

## MAINTAINING AESTHETIC QUALITY

In addition to its protective qualities, Ti-Pure™ TiO<sub>2</sub> by Chemours delivers and maintains the desired aesthetic quality of PVC products. PVC materials treated with TiO<sub>2</sub> retain their appearance longer, resisting discoloration such as yellowing and weathering effects, including gloss loss. This value provided by the Ti-Pure™ TiO<sub>2</sub> is particularly important for applications where aesthetics are valued, such as window frames and siding.



# Practical Applications and Industry Adoption

The practical applications of Ti-Pure™ TiO<sub>2</sub> by Chemours extend beyond enhancing the durability and longevity of PVC materials. It also plays a crucial role in improving the sustainability and energy efficiency of buildings.



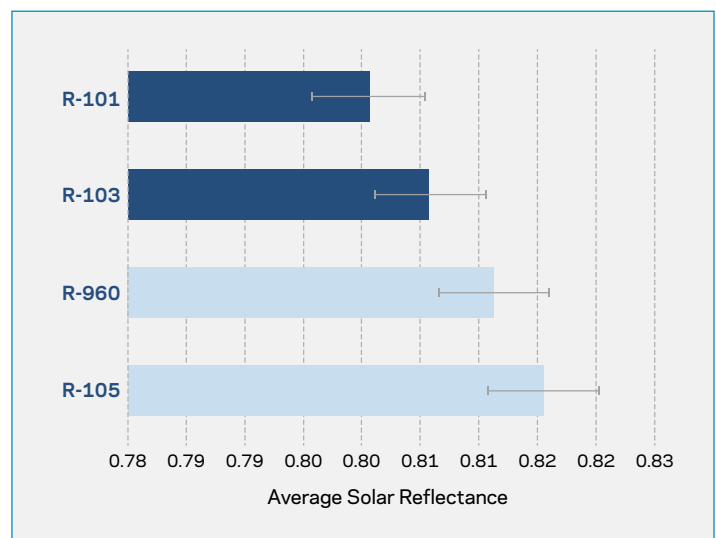


## UV PROTECTION

Titanium dioxide is incredibly effective in managing harmful UV rays when properly optimized. This property is crucial for outdoor PVC applications, where exposure to sunlight can drastically shorten the lifespan of materials by leading to their mechanical decline. The Ti-Pure™ TiO<sub>2</sub> by Chemours materials designed for PVC remain robust and reliable, even in harsh exterior exposure conditions.

## REFLECTING HEAT

Ti-Pure™ TiO<sub>2</sub> also contributes to the reflection of heat from solar exposure, contributing to the performance of exterior applications yielding energy efficiency to buildings. By reflecting sunlight, these materials help reduce the internal temperature of buildings, potentially lowering cooling costs and enhancing comfort.



## REDUCED ENERGY CONSUMPTION

The addition of Ti-Pure™ TiO<sub>2</sub> by Chemours to PVC mixtures offers an opportunity to reduce energy usage in buildings. By reflecting sunlight, PVC materials with TiO<sub>2</sub> help reduce heat absorption, leading to lower indoor temperatures. This means less reliance on air conditioning systems in hot weather, resulting in significant energy savings. Moreover, the improved strength and durability of TiO<sub>2</sub> in PVC materials contributes to lasting energy efficiency. By resisting wear and tear and maintaining their integrity over extended periods these materials decrease the need for replacements. This ultimately reduces the energy consumption linked to producing, transporting and installing materials promoting a sustainable and energy conscious approach to construction.





## INDUSTRY COLLABORATION FOR INNOVATION

The building and construction industry is in a constant state of evolution with companies like Chemours continuously exploring ways to improve the performance of building materials. Working with partners like NORAC Additives, Baerlocher, and Vibrantz, co-suppliers in the PVC value chain, Chemours is building robust formulation guidance to achieve the desired performance while further developing advanced PVC applications.

These collaborative endeavors focus on finding an equilibrium between enhancing the strength and lifespan of PVC materials and meeting the needs of the construction industry, which include affordability and ease of use. By nurturing these partnerships, the sector can speed up the creation and acceptance of solutions that cater to changing market demands and promote a greener built environment.





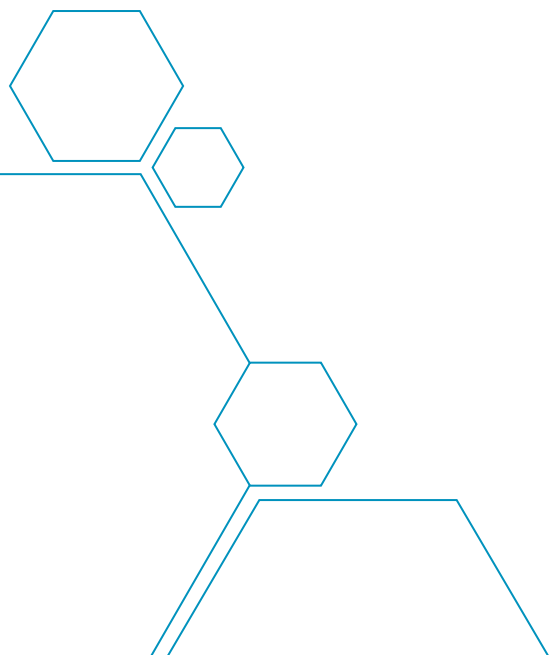
## CONCLUSION

Incorporating specially designed TiO<sub>2</sub> into exterior PVC building materials offers a multifaceted solution to the industry's pressing need for durability, longevity, sustainability, and cost-effectiveness. By fortifying PVC against UV radiation, heat, and weathering, Ti-Pure™ TiO<sub>2</sub> ensures that PVC materials retain performance and aesthetic appeal for longer periods. This translates to reduced maintenance, fewer replacements, and a smaller environmental footprint.

As research and development continue, we are confident that Ti-Pure™ TiO<sub>2</sub> by Chemours will play an increasingly vital role in shaping the future of modern construction. Through collaborative work with industry partners, Chemours is committed to fostering an industry that is both enduring and environmentally responsible.

## REFERENCES

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