# PozzSource Functional Extenders


# PozzSource Functional Extenders (PFE) Introduction

- PozzSource Industrial applications of fine powdered volcanic ash (SiO2)
  - First applications focused on the Concrete Industry
    - Products make concrete better, greener and less expensive
  - Currently offering PFE to the Coatings Industry
    - PFE are competitive as
      - PozzSource Hide - $TiO_2$ replacement
      - PozzSource Tuff - Abrasion and scuff resistance
      - PozzSource Silicate - Economic extender
- PozzSource Background
  - PozzSource develops products and technology for industrial applications
  - Founded in 2015
  - Specialized material sources include naturally occurring volcanic ash
  - Developed mineral sources in California and Utah
  - Built processing facility near Salt Lake City, Utah in 2021

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# Coatings Market Segments

- PozzSource Functional Extenders will provide value in several coatings areas
  - PozzSource Hide - **Optical - TiO2 replacement**
    - Replaces up to 60% of TiO2 (by volume)
    - Titanium Oxide is one of the most expensive inorganic pigments, replacement ultimately saves money, making the final product more economical
  - PozzSource Tuff - **Abrasion and scuff resistance** components
    - Geologic mineral is literally “tuff”
    - Toughness as proven coatings compound improves performance
  - PozzSource Silicate - **Functional Extender**
    - Provides excellent strength to the existing paint formulations.
    - Improves the dry film characteristics while having no adverse effects on existing properties

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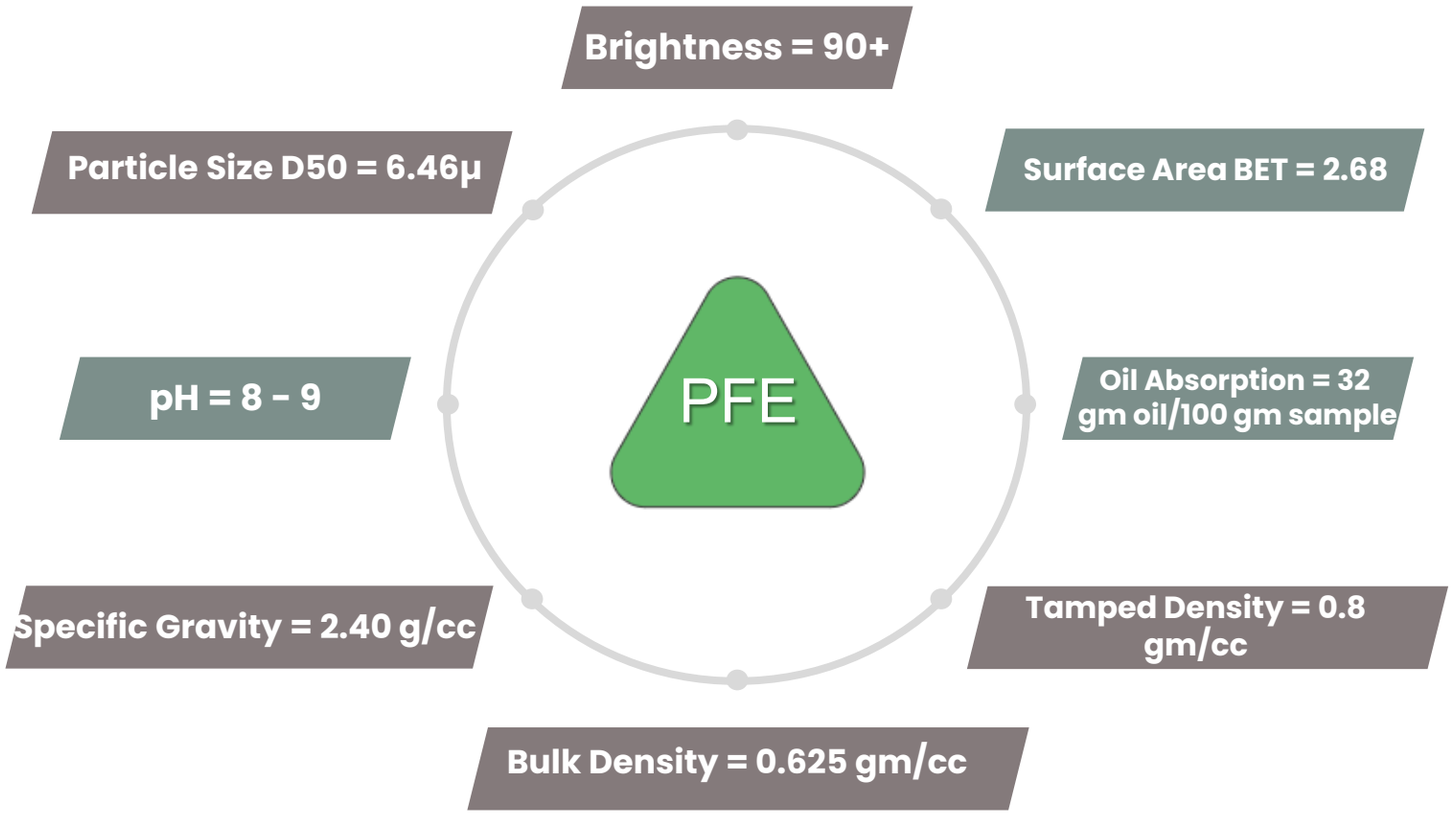
# PHYSIOCHEMICAL PROPERTIES

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# Benefits of Using PozzSource Functional Extenders

- Wet Properties
  - No adverse effect on the wet properties such as:
    - Viscosity (low, medium & high shear)
    - pH
    - Sag resistance
    - Heat Aged stability
- Optical Properties
  - Up to 60% Replacement of TiO2 (Volume basis) has no adverse impact on Hiding Power / Opacity of the finished paint
- Dry Film Properties
  - Improvement in physical, chemical and mechanical properties include
    - Taber Abrasion
    - Wet Scrub Resistance
    - Dry Scrub / Burnish Resistance
    - Spot Resistance – House Hold Chemicals

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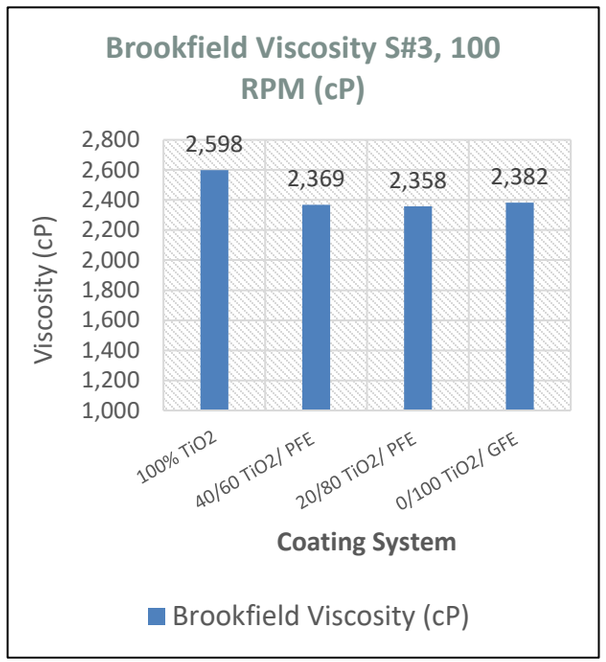
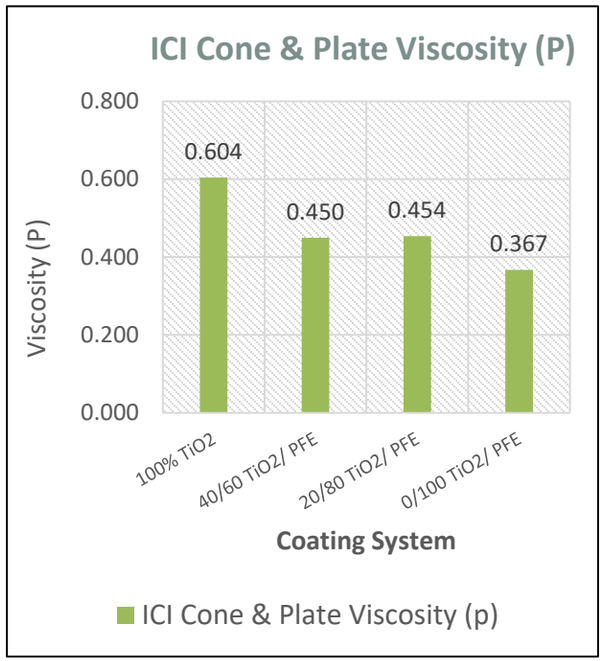
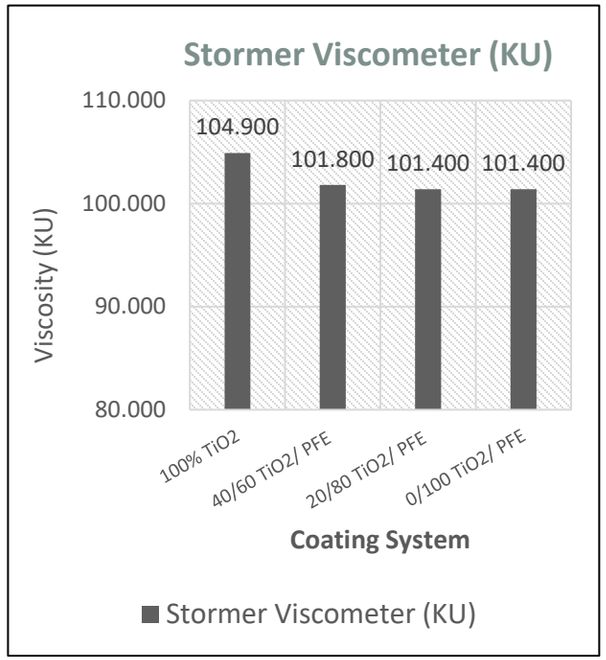
# Wet Properties

- Viscosity – Low Shear , Medium Shear And High Shear
  - Incorporation of PFE into an existing paint formulation has no significant changes on the viscosity of the finished paint
  - Tests performed with 60%, 80% and 100% TiO2 replacement with PFE **PozzSource Hide** Product

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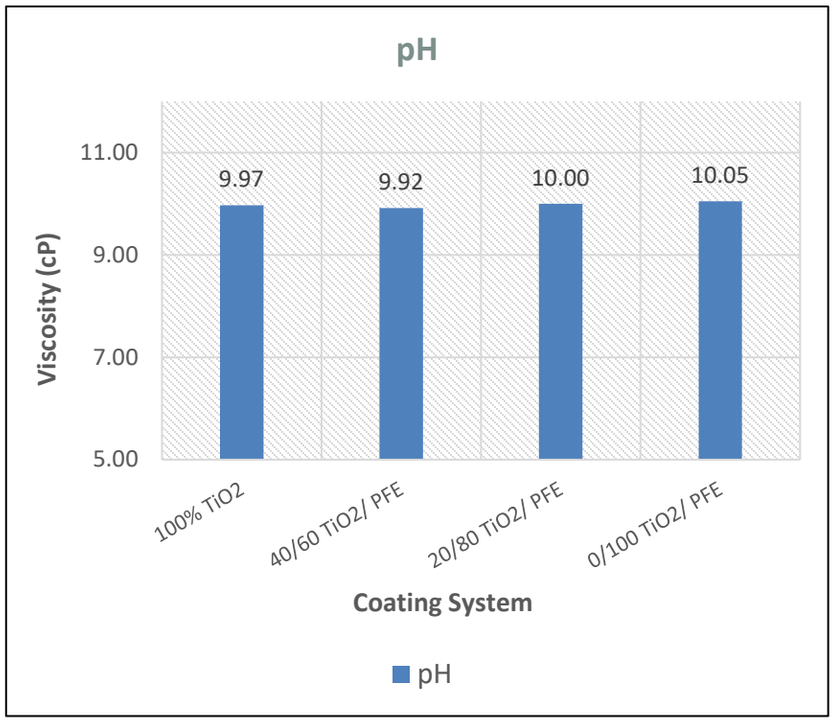
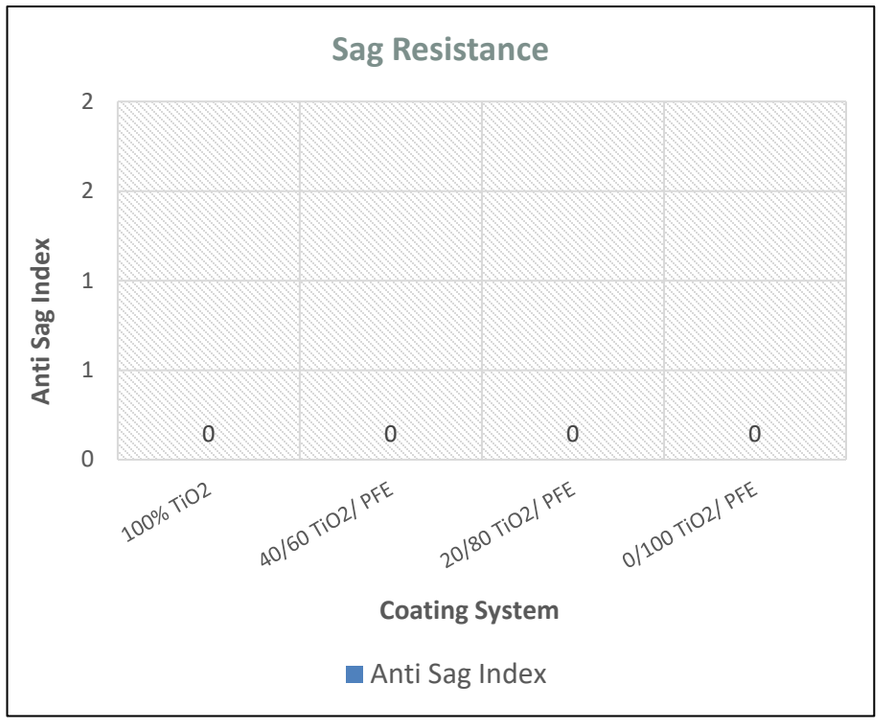
# Wet Properties

- pH & Sag Resistance
  - Incorporation of PFE into an existing paint formulation  has no significant changes on the pH or the sag resistance of the final product.
  - Tests performed with 60%, 80% and 100% TiO2 replacement with PFE **PozzSource Hide** Product

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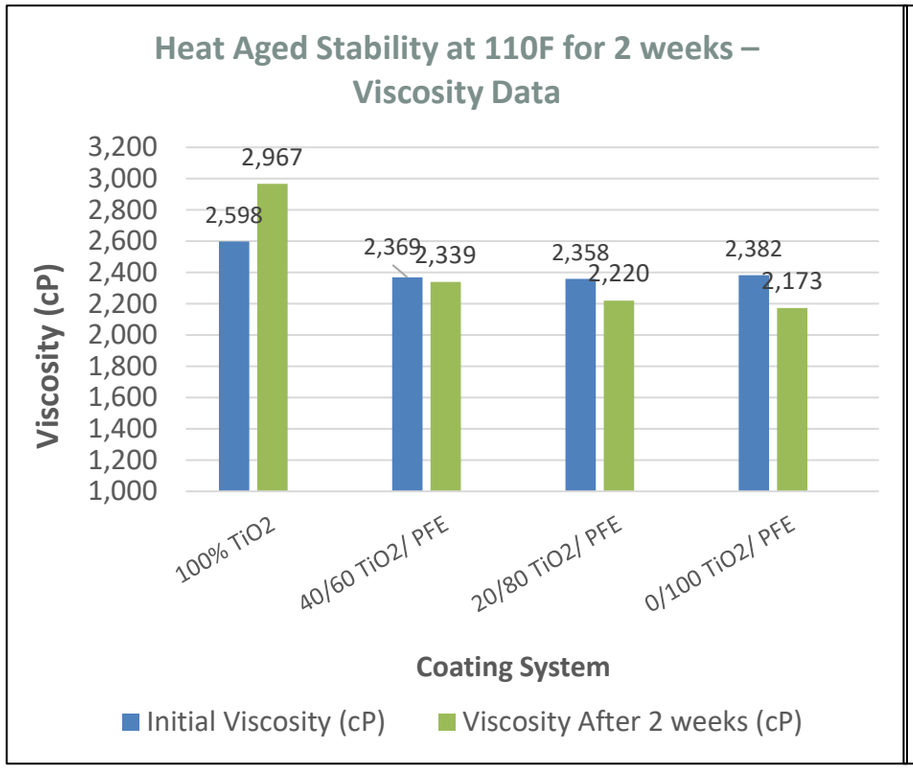
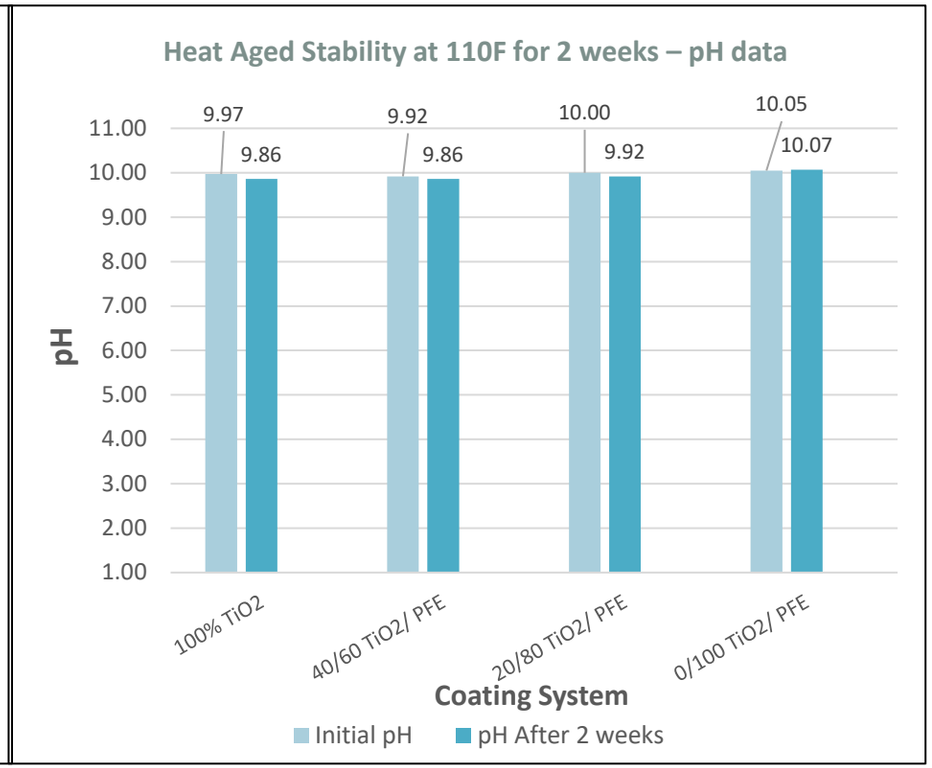
# Wet Properties

## HEAT AGED STABILITY

- PFE formulation shows good heat aged stability at 110° F over 2 weeks with no phase separation, pigment flooding, or floating, syneresis
- All the variations showed soft settling were easily re-dispersible
- Tests performed with 60%, 80% and 100% TiO2 replacement with PFE **PozzSource Hide** Product

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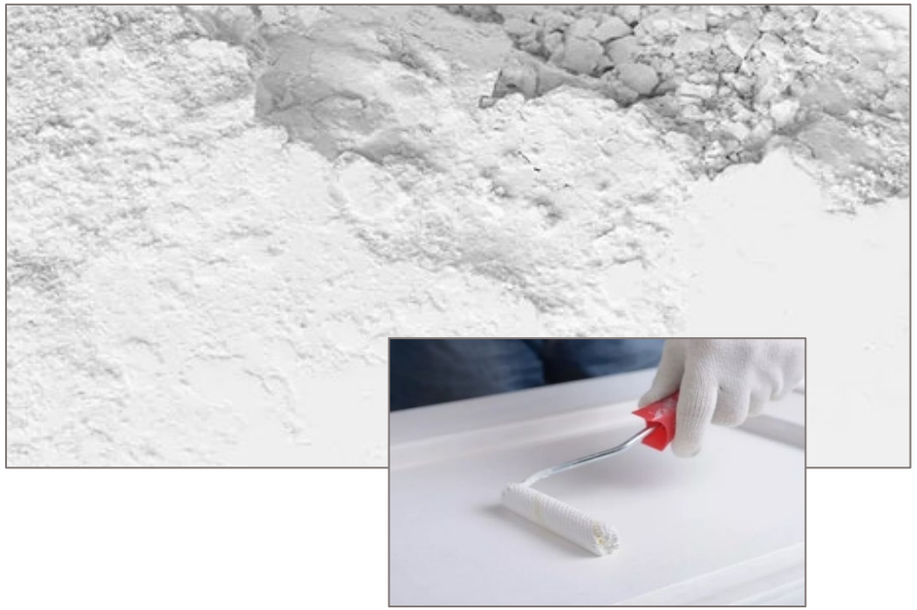
# Optical Properties

- Titanium dioxide ($TiO_2$) is the par excellence in the industry and the world's best-selling inorganic pigment. However, titanium is a product whose high price is subject to large variations due to product availability.

- These price increases affect the competitiveness of finished products, so the search for an alternative to titanium dioxide has generated a variety of possibilities to optimize its use.

- PFE's excellent optical properties provide both technical and economic advantages in the substitution of $TiO_2$, which includes up to 60% replacement of TiO2 for non-optimized formulations on weight basis.



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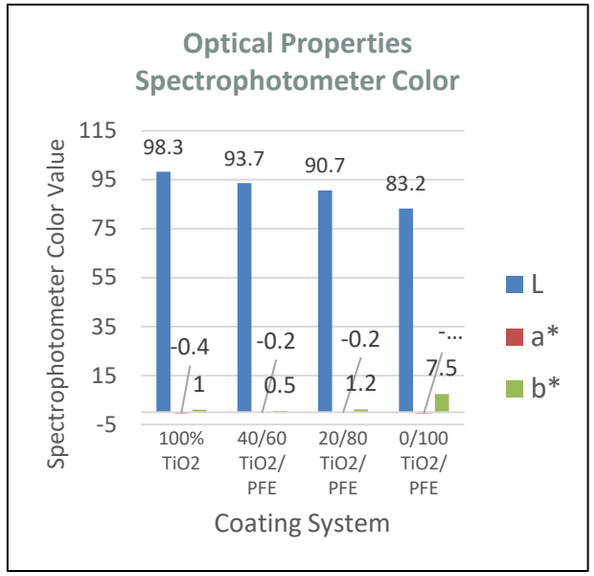
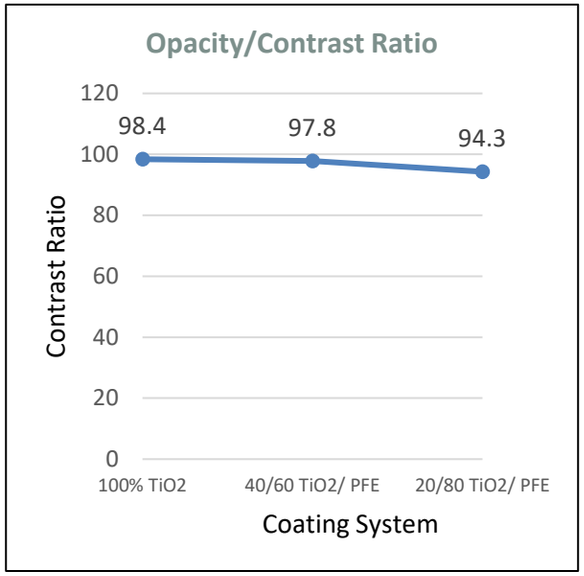
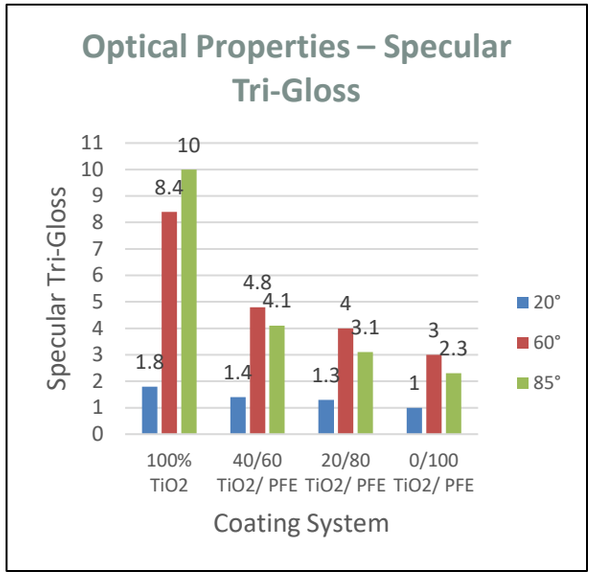
# Optical Properties

- Opacity, Spectrophotometer Color, Specular Gloss
  - Formulation containing 60% PFE have similar Opacity/Hiding and color characteristics of the formulation containing 100% $TiO_2$

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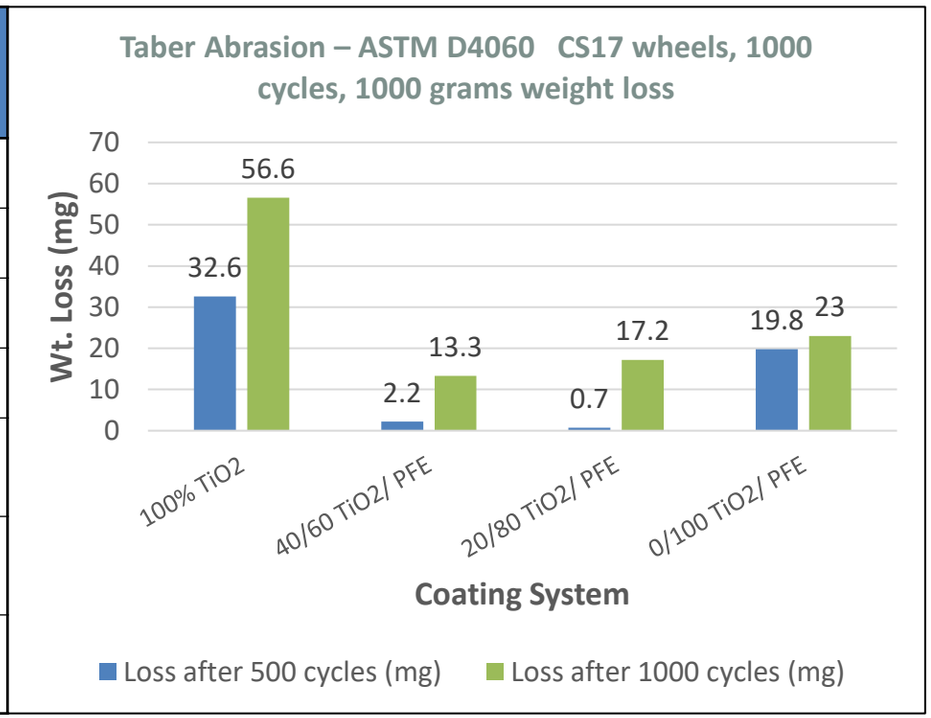
# Dry Film Properties

- Improved Taber Abrasion
  - Formulation containing PFE have significant improvement in the Taber abrasion and lower weight loss after 1,000 cycles, compared to those containing TiO2.

| Formulations | Panel initial wt. (g) | Panel wt. after 500 cycles (g) | Panel wt. after 1000 cycles (g) | wt. loss after 500 cycles (mg) | loss after 1000 cycles (mg) |
|---|---|---|---|---|---|
| 100% TiO2 | 72.6671 | 72.6345 | 72.6105 | 32.6 | 56.6 |
| 40/60 TiO2/ PFE | 72.1887 | 72.1865 | 72.1754 | 2.2 | 13.3 |
| 20/80 TiO2/ PFE | 72.0662 | 72.0655 | 72.049 | 0.7 | 17.2 |
| 0/100 TiO2/ PFE | 68.33 | 68.3102 | 68.307 | 19.8 | 23 |
| 40/60 TiO2/nepheline syenite | 70.3546 | 70.3525 | 70.3391 | 2.1 | 15.5 |
| 20/80 TiO2/nepheline syenite | 65.8104 | 65.8071 | 65.7958 | 3.3 | 14.6 |
| 0/100 TiO2/nepheline syenite | 69.9737 | 69.9699 | 69.9627 | 3.8 | 11 |

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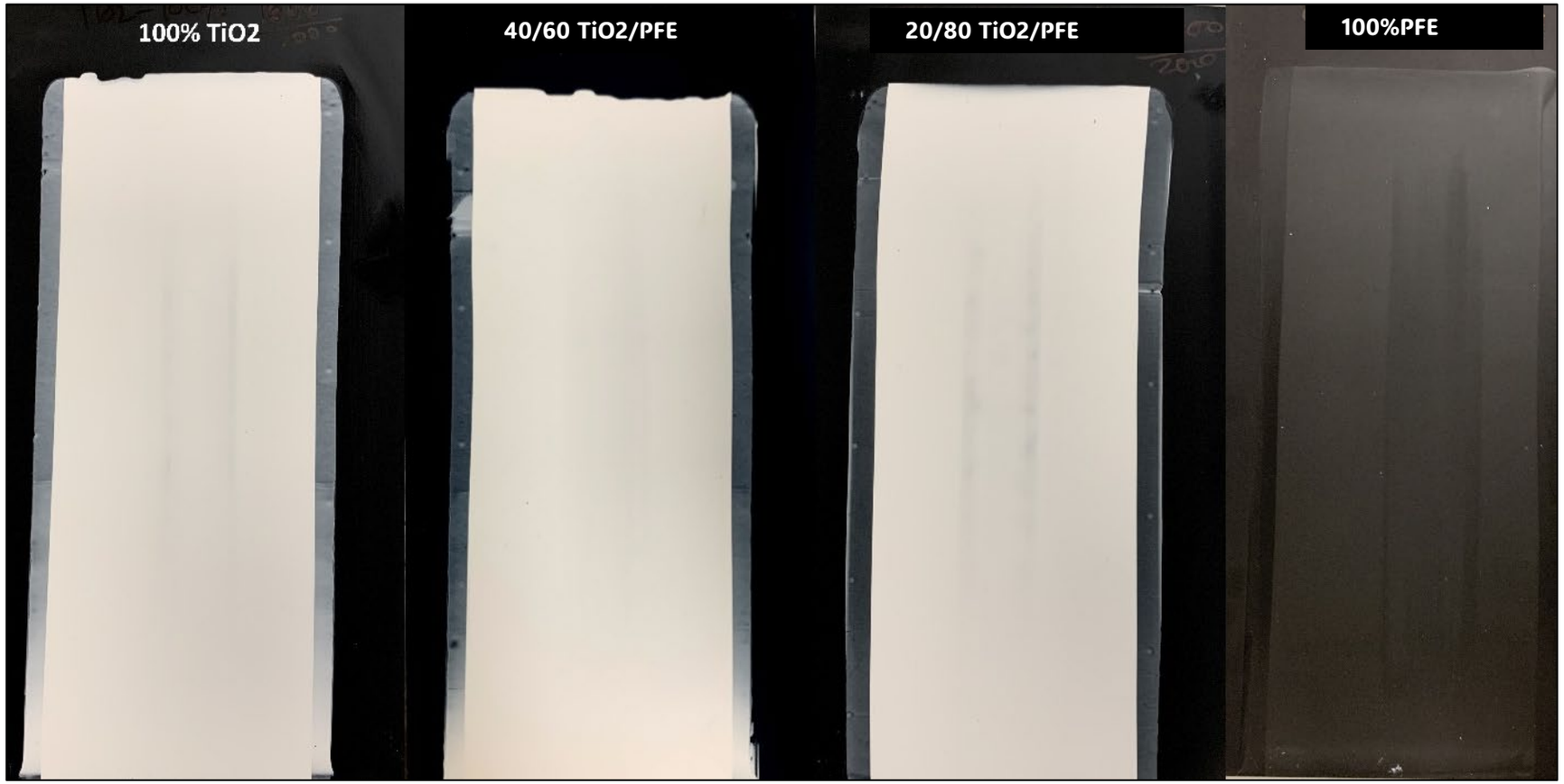
# Dry Film Properties

- Wet Scrub Resistance - TiO2 vs PFE formulation
  - 40/60 ratio of TiO2/PFE has better wet scrub resistance compared to variation with 100% TiO2

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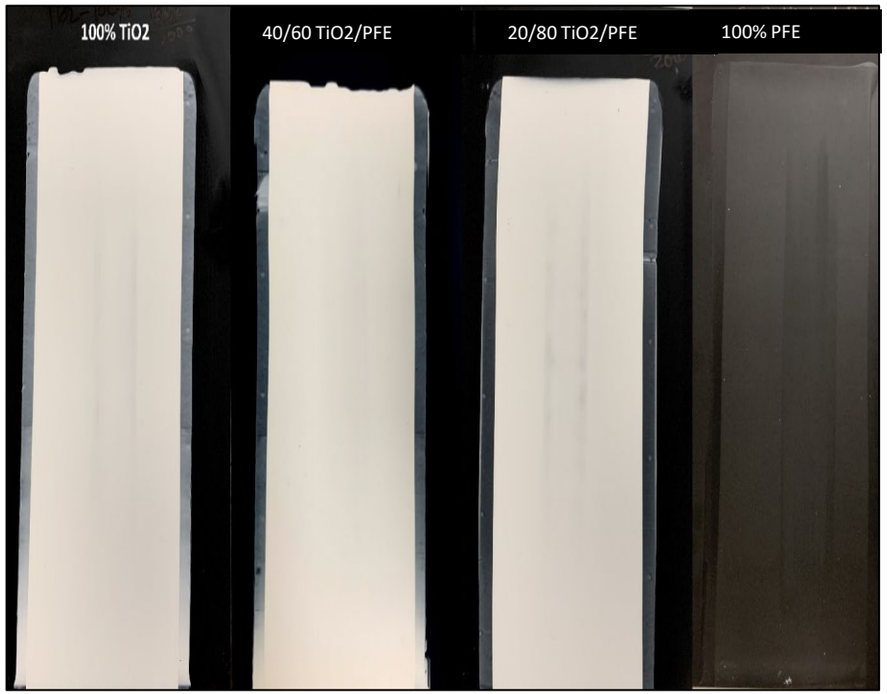
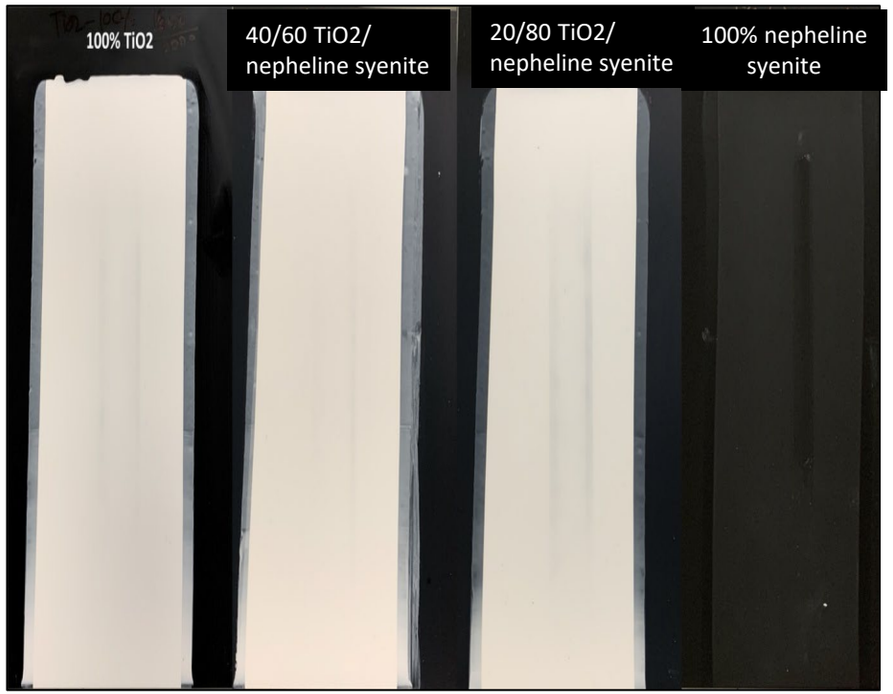
# Dry Film Properties

- Wet Scrub Resistance - TiO2 vs PFE vs nepheline syenite
  - 40/60 ratio of TiO2/PFE has better wet scrub resistance compared to variations containing 100% TiO2 and nepheline syenite.

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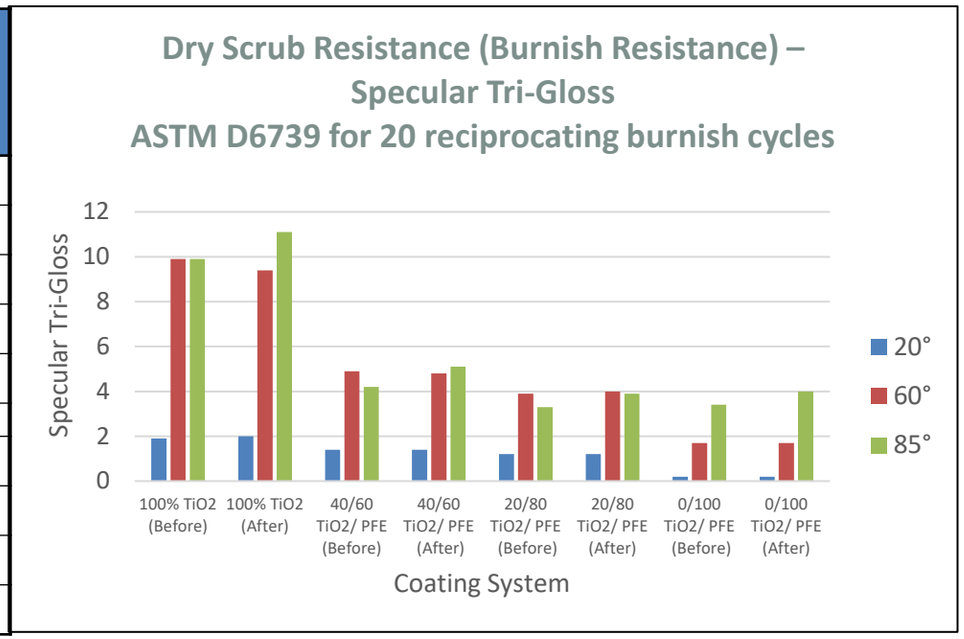
# Dry Film Properties

- Dry Scrub // Burnish Resistance – Specular Tri Gloss
  - 100 TiO2, 40/60 and 20/80 ratio of TiO2/PFE has better burnish resistance compared to 40/60 and 20/80 ratio of TiO2/ nepheline syenite

| Formulations | Dry Film Thickness (Mil) | Initial Tri-Gloss | | | Tri-Gloss (After burnish resistance test) | | | 85° % gloss change |
|---|---|---|---|---|---|---|---|---|
| | | 20° | 60° | 85° | 20° | 60° | 85° | |
| **TiO2/PFE** | | | | | | | | |
| 100/0 | 2 | 1.9 | 9.9 | 9.9 | 2 | 9.4 | 11.1 | 12.12 |
| 40/60 | | 1.4 | 4.9 | 4.2 | 1.4 | 4.8 | 5.1 | 21.43 |
| 20/80 | | 1.2 | 3.9 | 3.3 | 1.2 | 4 | 3.9 | 18.18 |
| 0/100 | | 0.2 | 1.7 | 3.4 | 0.2 | 1.7 | 4 | 17.65 |
| | | | | | | | | |
| **TiO2/nepheline syenite** | | | | | | | | |
| 40/60 | 2 | 1.5 | 4.7 | 4.3 | 1.5 | 4.8 | 5.3 | 23.26 |
| 20/80 | | 1.3 | 3.9 | 4.6 | 1.3 | 4.1 | 5.7 | 23.91 |
| 0/100 | | 0.2 | 1.7 | 3.2 | 0.2 | 1.7 | 3.7 | 15.63 |

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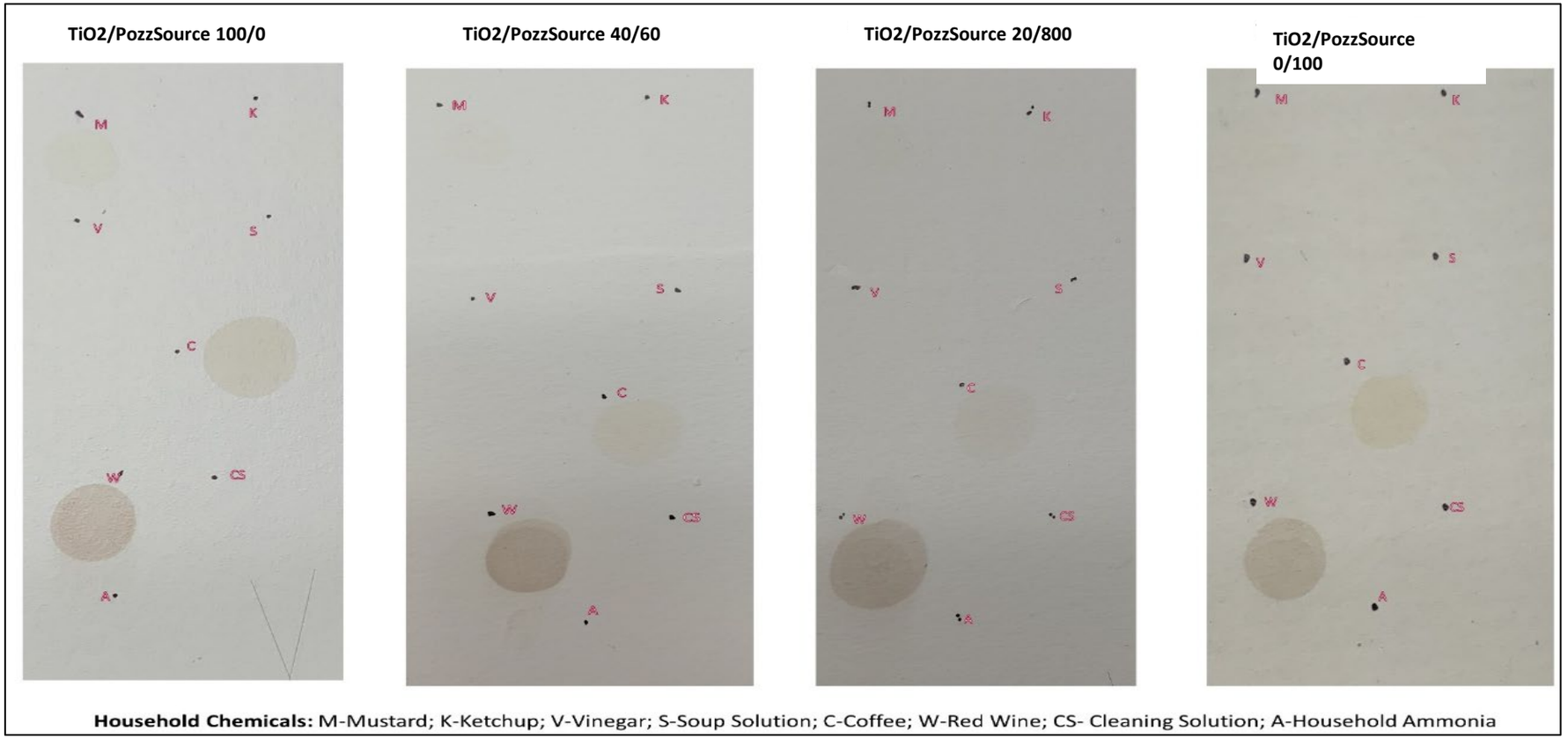
# Dry Film Properties

- Stain Resistance – Household Chemicals
  - There's no adverse effect on resistance to household chemicals or spot test that is visible for PFE vs that of TiO2.

**15 Minutes**

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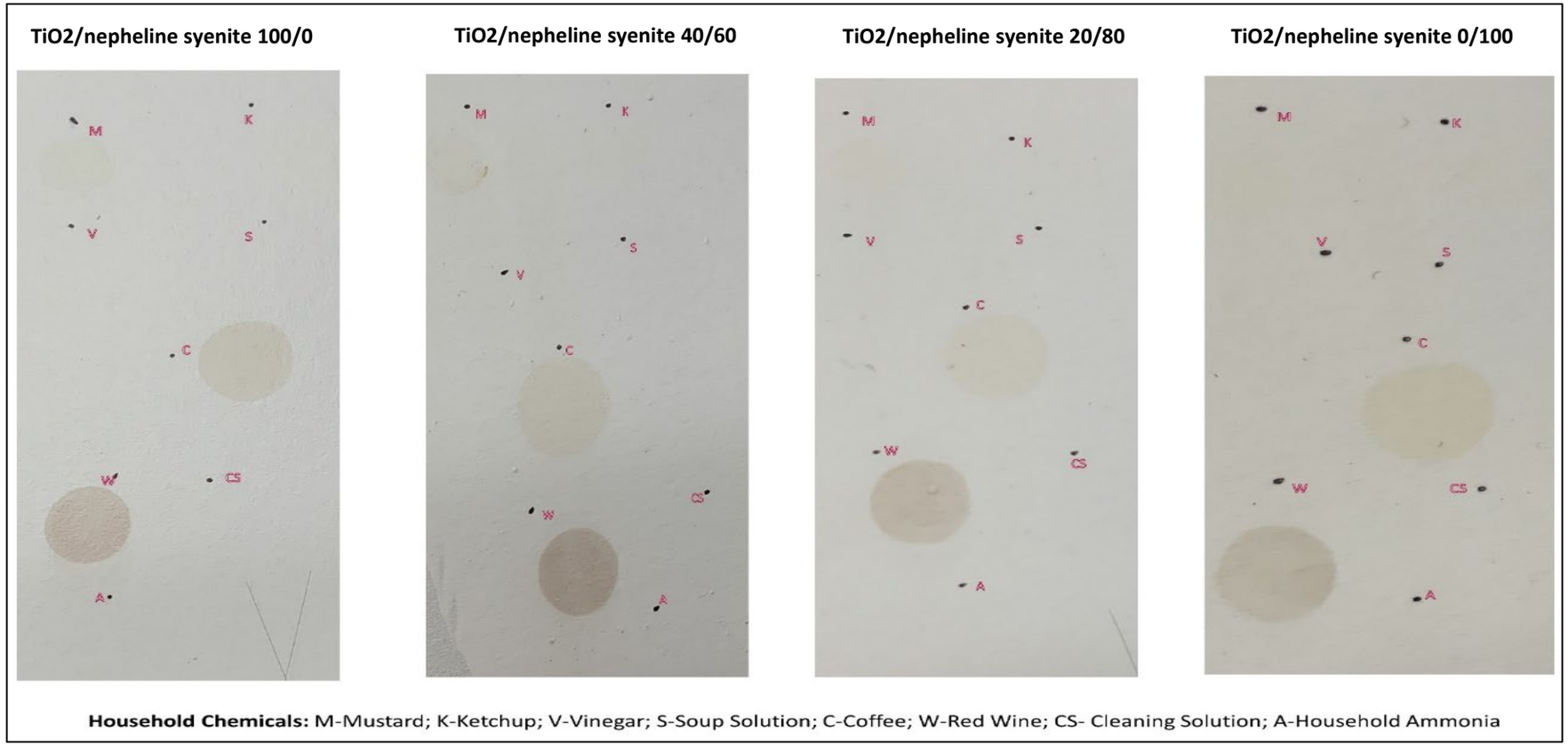
# Dry Film Properties

- Stain Resistance – Household Chemicals
  - There's no adverse effect on resistance to household chemicals or spot test that is visible for PFE vs that of nepheline syenite formulation. **15 Minutes**




**Household Chemicals:** M-Mustard; K-Ketchup; V-Vinegar; S-Soup Solution; C-Coffee; W-Red Wine; CS- Cleaning Solution; A-Household Ammonia

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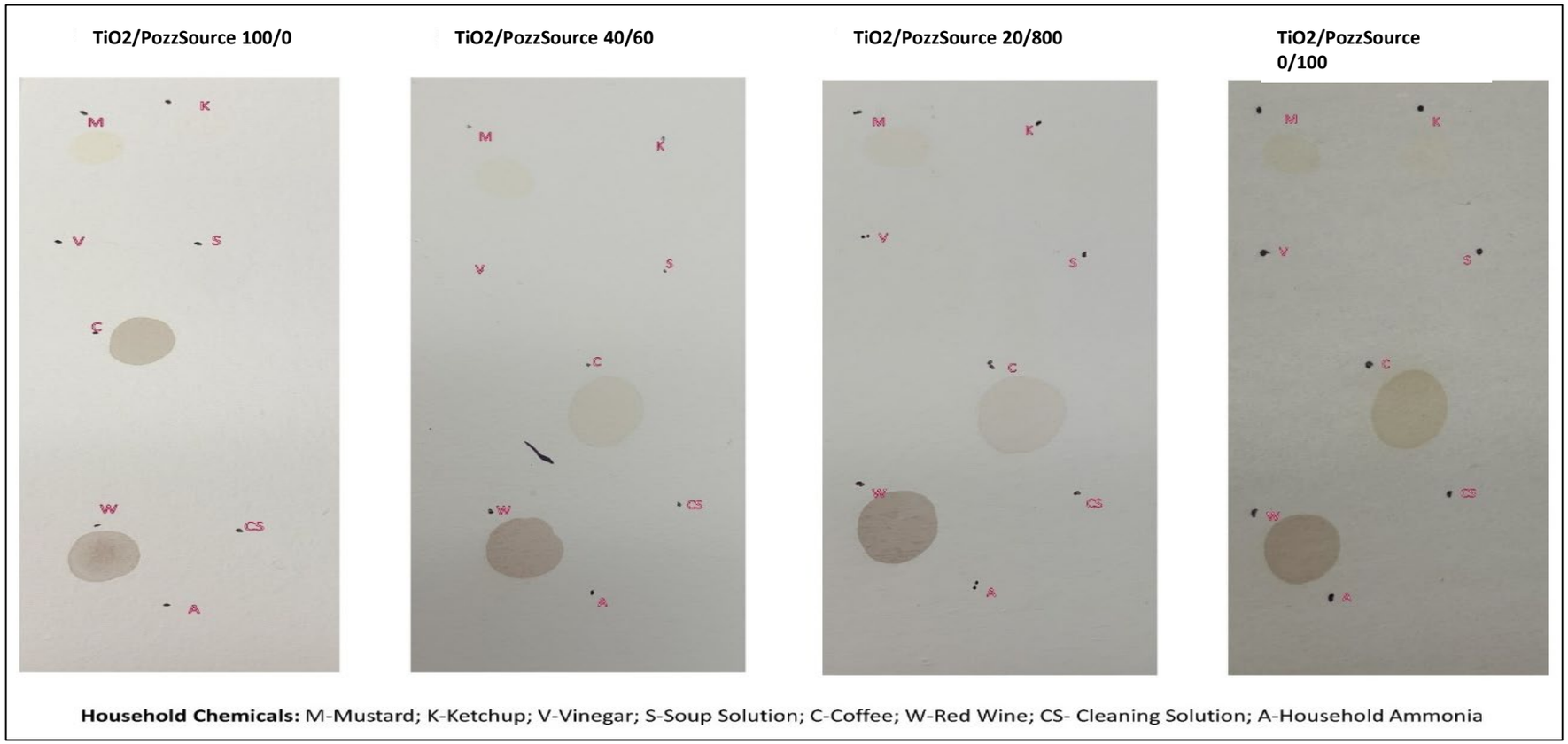
# Dry Film Properties

- Stain Resistance – Household Chemicals
  - There's no adverse effect on resistance to household chemicals or spot test that is visible for PFE vs that of TiO2.

**60 Minutes**




**Household Chemicals:** M-Mustard; K-Ketchup; V-Vinegar; S-Soup Solution; C-Coffee; W-Red Wine; CS- Cleaning Solution; A-Household Ammonia

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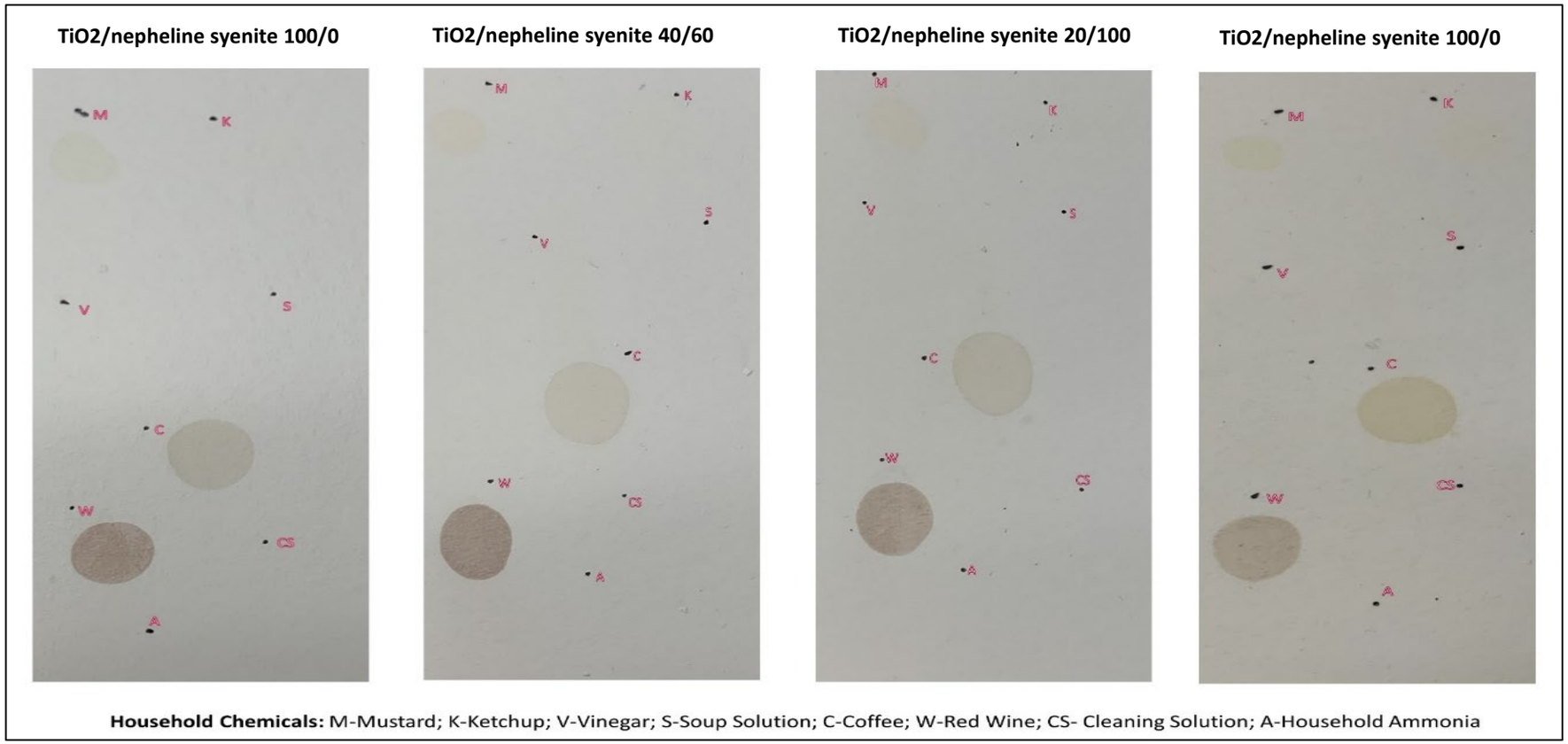
# Dry Film Properties

- Stain Resistance – Household Chemicals
  - There's no adverse effect on resistance to household chemicals or spot test that is visible for PFE vs that of nepheline syenite formulation. **60 Minutes**




**Household Chemicals:** M-Mustard; K-Ketchup; V-Vinegar; S-Soup Solution; C-Coffee; W-Red Wine; CS- Cleaning Solution; A-Household Ammonia

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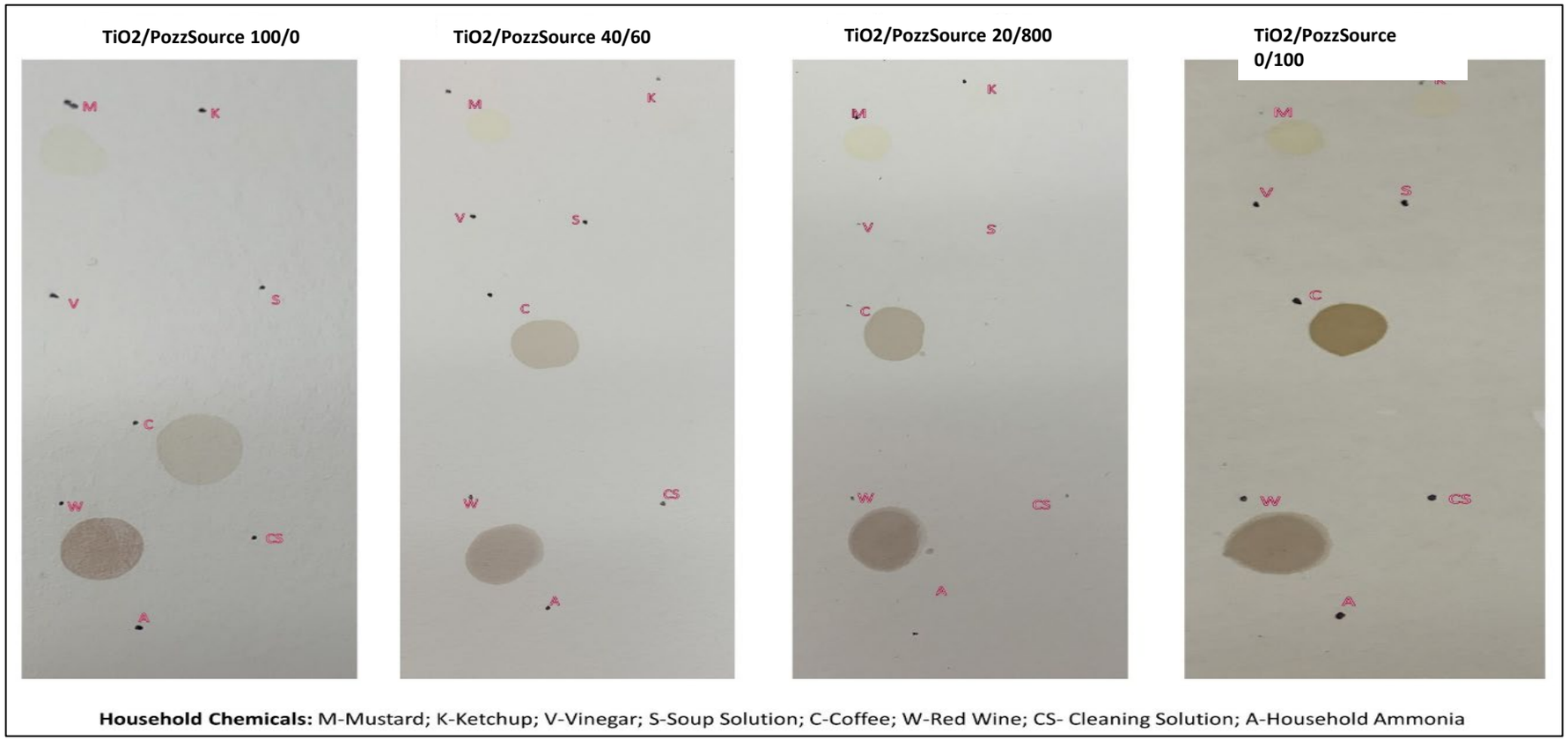
# Dry Film Properties

- Stain Resistance – Household Chemicals
  - There's no adverse effect on resistance to household chemicals or spot test that is visible for PFE vs that of TiO2.

**20 Hours**




**Household Chemicals:** M-Mustard; K-Ketchup; V-Vinegar; S-Soup Solution; C-Coffee; W-Red Wine; CS- Cleaning Solution; A-Household Ammonia

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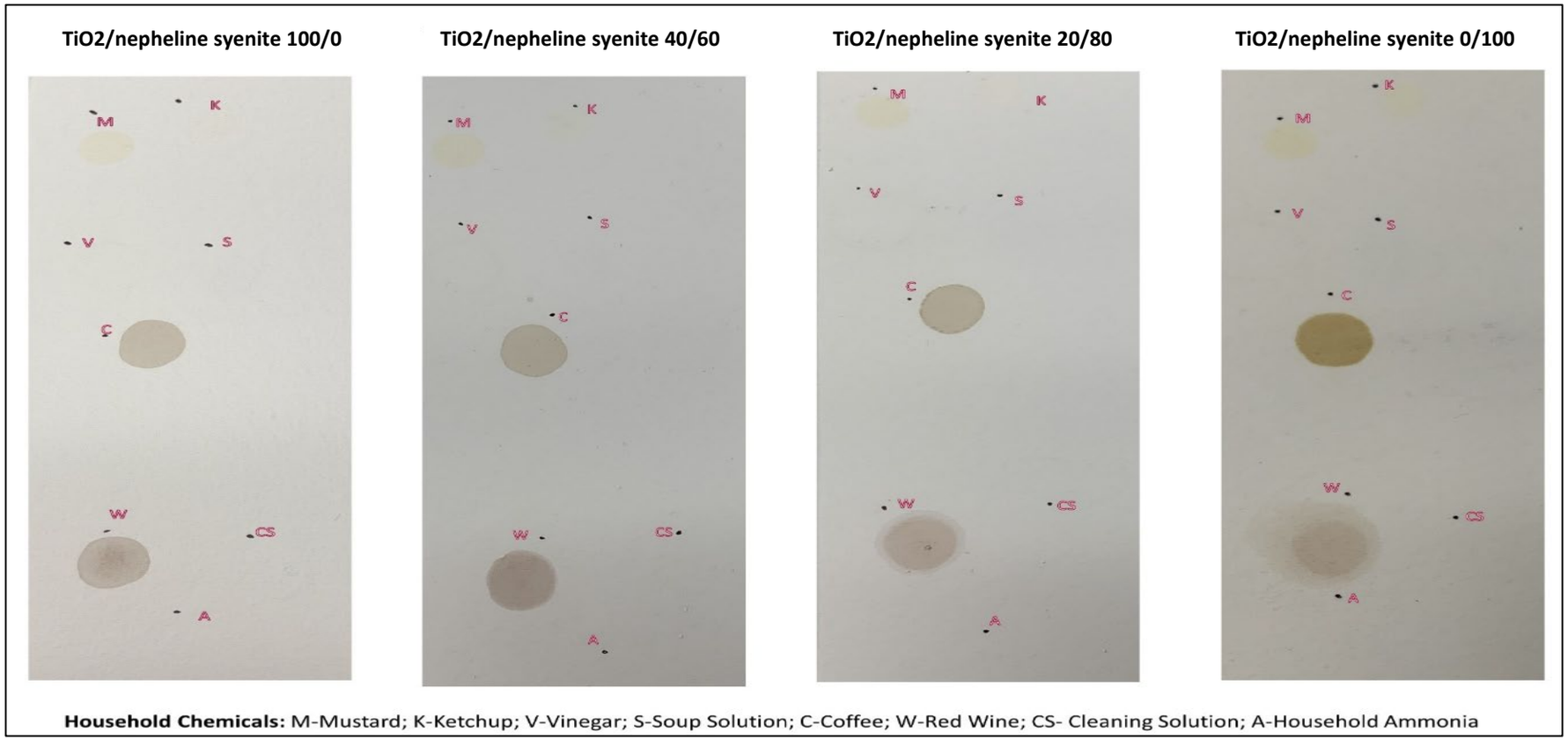
# Dry Film Properties

- Stain Resistance – Household Chemicals
  - There's no adverse effect on resistance to household chemicals or spot test that is visible for PFE vs that of nepheline syenite formulation. **20 Hours**




**Household Chemicals:** M-Mustard; K-Ketchup; V-Vinegar; S-Soup Solution; C-Coffee; W-Red Wine; CS- Cleaning Solution; A-Household Ammonia

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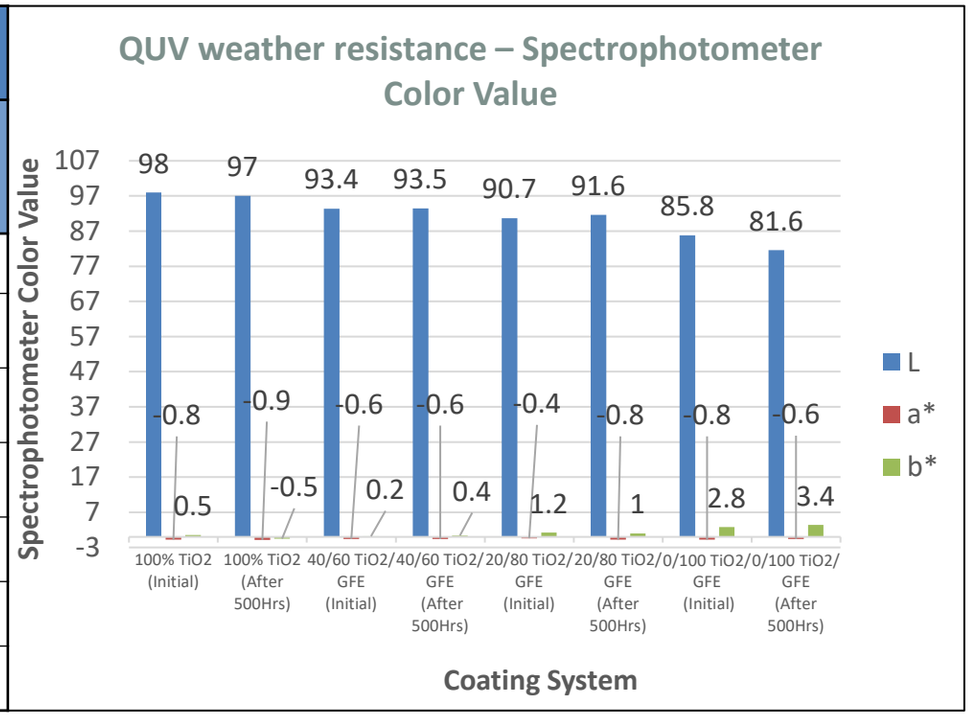
# Dry Film Properties

- QUV Accelerated Weather Resistance – Spectrophotometric Color
  - No adverse effect on the color, gloss or weather resistance for PFE vs that of $TiO_2$ or nepheline syenite formulation
  - The test was done in accordance with ASTM D4329 for 500 hours

| Formulations | Spectrophotometric Color, ASTM D2244 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Initial Reading | | | After 500 Hours | | | ΔE | |
| | L* | a* | b* | L* | a* | b* | | |
| 100% TiO2 | 98 | -0.8 | 0.5 | 97 | -0.9 | -0.5 | 1.4 | |
| 40/60 TiO2/ PFE | 93.4 | -0.6 | 0.2 | 93.5 | -0.6 | 0.4 | 0.2 | |
| 20/80 TiO2/ PFE | 90.7 | -0.4 | 1.2 | 91.6 | -0.8 | 1.0 | 1.0 | |
| 0/100 TiO2/ PFE | 85.8 | -0.8 | 2.8 | 81.6 | -0.6 | 3.4 | 4.2 | |
| 40/60 TiO2/nepheline syenite | 96.2 | -0.8 | 0.1 | 95.8 | -1 | 0.2 | 0.5 | |
| 20/80 TiO2/nepheline syenite | 95.2 | -1 | 0.3 | 94.4 | -1 | -0.5 | 1.1 | |
| 0/100 TiO2/nepheline syenite | 92.2 | -1.3 | 1.3 | 92.8 | -1.3 | 0.1 | 1.3 | |

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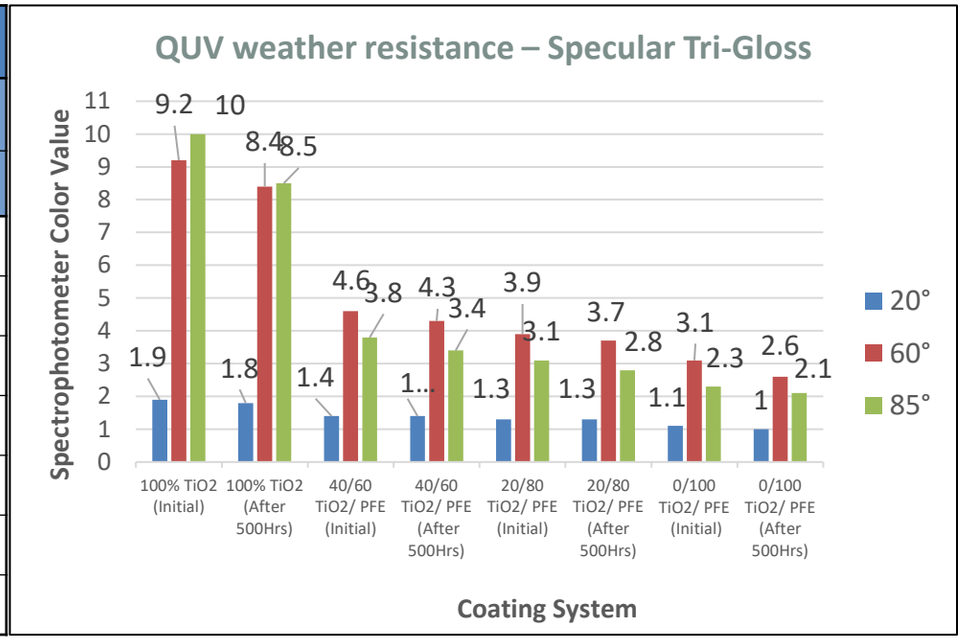
# Dry Film Properties

- QUV Accelerated Weather Resistance – Specular Tri Gloss
  - No significant loss in gloss after 500 Hours of QUV–A Exposure.
  - The test was done in accordance with ASTM D4329 for 500 hour.

| Formulations | Gloss readings | | | | | |
|---|---|---|---|---|---|---|
| | Initial Reading | | | After 500 Hours | | |
| | 20° | 60° | 85° | 20° | 60° | 85° |
| 100% TiO2 | 1.9 | 9.2 | 10 | 1.8 | 8.4 | 8.5 |
| 40/60 TiO2/ PFE | 1.4 | 4.6 | 3.8 | 1.4 | 4.3 | 3.4 |
| 20/80 TiO2/ PFE | 1.3 | 3.9 | 3.1 | 1.3 | 3.7 | 2.8 |
| 0/100 TiO2/ PFE | 1.1 | 3.1 | 2.3 | 1 | 2.6 | 2.1 |
| 40/60 TiO2/nepheline syenite | 1.5 | 4.8 | 4.1 | 1.4 | 4.2 | 3.6 |
| 20/80 TiO2/nepheline syenite | 1.4 | 4 | 3.2 | 1.3 | 3.6 | 2.7 |
| 0/100 TiO2/nepheline syenite | 1.3 | 3.2 | 2.5 | 1.3 | 2.8 | 2.2 |

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# Contact Information

- For more information about how PozzSource Functional Extenders can help improve the performance of coatings formulations, contact your PozzSource representative
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