

# IGM RESINS

Robust UV curable coatings  
technology to enhance LVT  
flooring properties

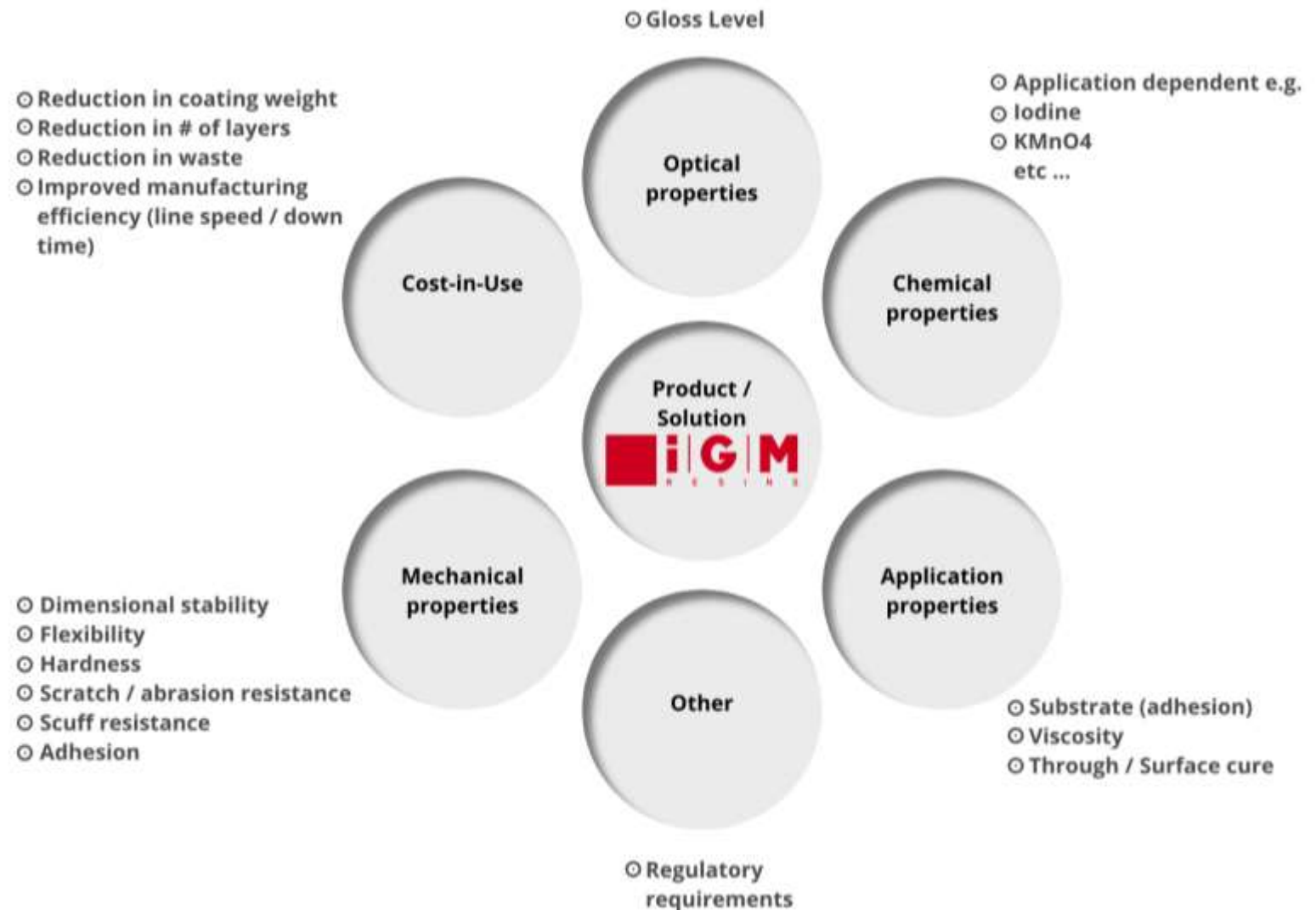
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# Focus on Urethane acrylates for LVT

Following our first product guide on Vinyl flooring (available on our website), our laboratory has designed this specific study on LVT for our best aliphatic urethane acrylates.

These products are tested in a matte coating formulation for stain resistance, yellowing resistance evaluation, abrasion resistance and flexibility.

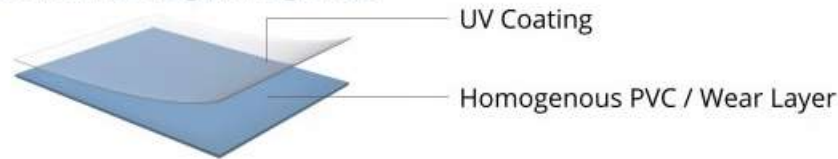


- Development in re-modelling activities and new construction of residential buildings boosts the demand of floorings.
- Key factors driving high demand of vinyl floorings include product performance, water resistance, durability and growing adoption in developed and developing countries.
- Vinyl sheets and vinyl composite tiles possess superior properties such as water resistance and slip resistance. They are easy to clean and hence are typically used in healthcare and educational buildings.
- Due to the versatility of its graphic layer, luxury vinyl tiles provide superior design capabilities emulating the look of natural wood, marble, granite, concrete or other types of flooring.
- Luxury vinyl tiles is taking share from other flooring products and is becoming a significantly larger part of flooring company's portfolio.
- Luxury vinyl tiles is an extremely attractive opportunity for many flooring manufacturers with the category currently growing at more than 20 percent growth per year.
- Effective disposal of vinyl flooring waste is a challenge.

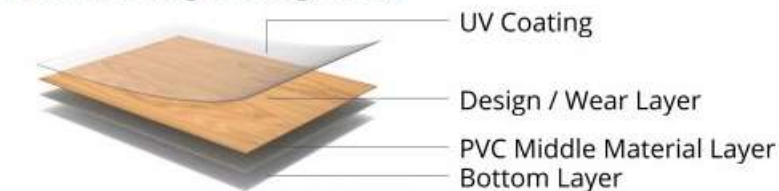
**Luxury Vinyl Tiles is highest growth opportunity in Vinyl Flooring segment**

# Resilient Flooring : Vinyl based Flexible and Rigid Flooring

## Flexible Roll Flooring Homogenous



## Flexible Roll Flooring Heterogeneous



## Flexible LVT Flooring



## Inflexible / Rigid LVT Flooring



### Layer Functionality

- **UV Coating** – scratch, stain and scuff / marking resistance.
- **Wear Layer** – will gradually get worn away with time from the passage of feet and the movement of furniture.
- **Design Layer** – wood, stone, tile or other designs. Typically, inkjet printed PVC film or paper.
- **PVC Middle Material Layer** – glass fiber reinforced for dimensional stability.
- **PVC based Core** – wood polymer core (**WPC**) or stone polymer core (**SPC**) for dimensional stability. Note – in WPC structure there is an additional PVC layer between PVC based Core and Design Layer.
- **Bottom Layer** – sound insulation and comfort improvement.

### Flexible Roll versus Flexible LVT Flooring

- Low cost, high durability and easy to maintain.
- Easy to heat weld (seams) and flash cove (wall base) for spaces demanding superior hygiene and infection control.

### Inflexible / Rigid LVT Flooring WPC and SPC

- Hybrid LVT combining the benefits of Flexible LVT and Laminate Flooring.
- Modular flexibility and click system for installation.
- Water proof and hide subfloor imperfections, can be installed without acclimation and expansion gaps.
- WPC composition - wood dust, PVC, calcium carbonate, fillers and foaming agents. Low density (foamed) contributing to weight reduction, comfort and sound insulation.
- SPC composition – PVC, calcium carbonate. High density contributing to impact and dent resistance.

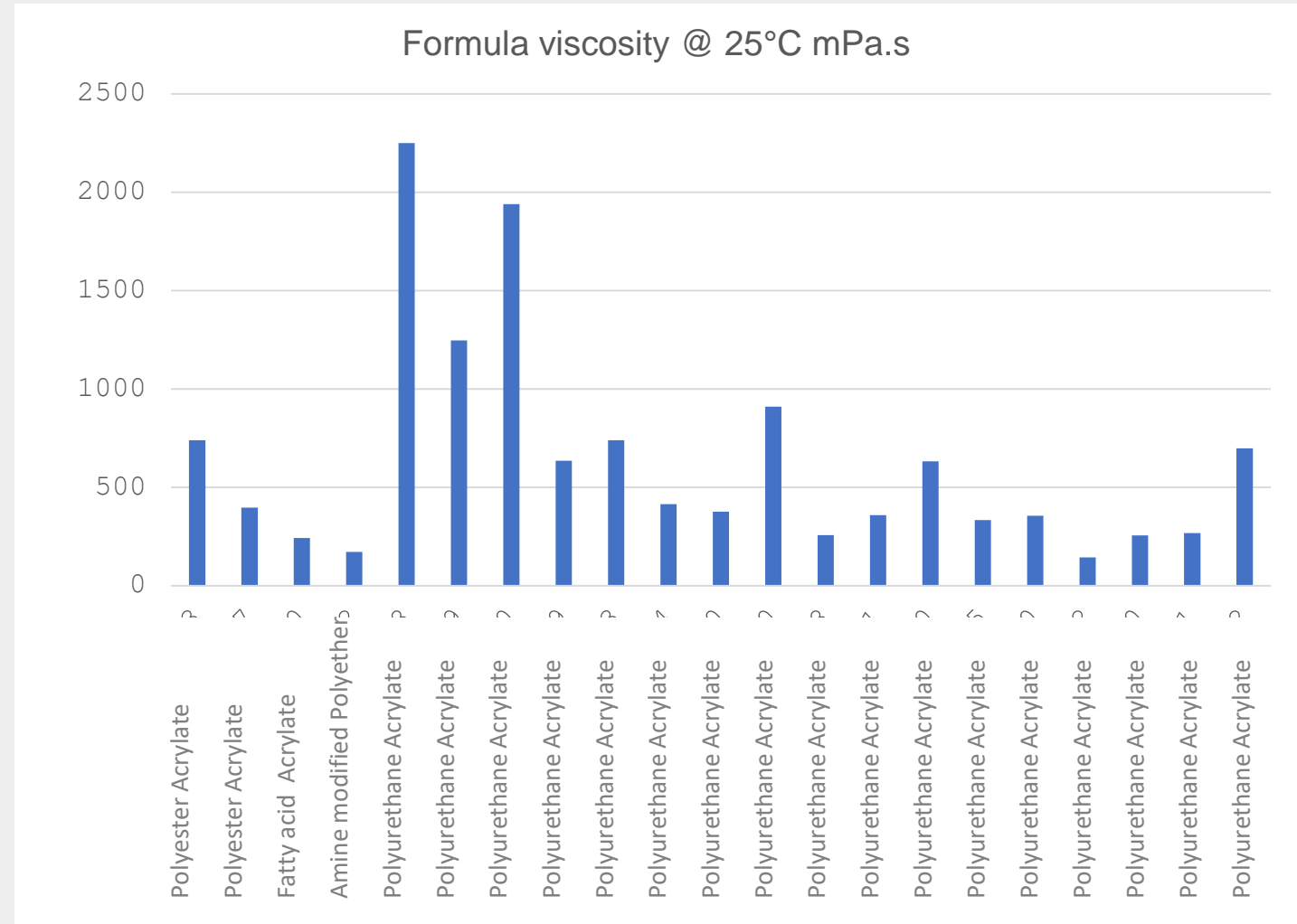
# Product tested in the initial study

Chemical identity	Functionality	Viscosity   mPa.s at °C	T   °C	Formula viscosity @ 25°C	Tin Free
Polyester	4	4000	60	740	Yes
Polyester	4	9500	25	396	Yes
Fatty acid modified	6	9000	25	242	Yes
Amine modified polyether	4	2500	25	172	Yes
Aliphatic urethane	2	16000	60	2250	
Aliphatic urethane	2	30000	25	1247	
Aliphatic urethane	3	5800	60	1940	
Aliphatic urethane	2	3250	60	635	
Aliphatic urethane	2	3000	60	740	
Aliphatic urethane	2.5	14000	60	415	
Aliphatic urethane	2	12000	25	376	
Aliphatic urethane	2	3500	60	910	

Chemical identity	Functionality	Viscosity   mPa.s at °C	T   °C	Formula viscosity @ 25°C	Tin Free
Aromatic urethane	4	6000	25	257	
Aliphatic urethane	6	2000	60	359	Yes
Aliphatic urethane	2	65000	25	632	
Aliphatic urethane	10	80000	25	333	
Aliphatic urethane	6	2000	60	355	
Aliphatic urethane	6	5500	25	144	Yes
Aromatic urethane	6	28500	25	255	Yes
Aliphatic urethane	2	8000	25	268	
Aliphatic urethane	3	29500	25	698	

# Formulation & viscosity of initial study

Identity	%
Urethane or Polyester Acrylate	60,0
Monomer 1	18,9
Monomer 2	11,8
Monomer 3	6,3
Photoinitiator	3,0



# Aliphatic urethane acrylate selection for LVT

Product	Functionality	Viscosity   mPa.s at °C	T   °C	Product Attributes	EU REACH *	USA TSCA *	China IECSC *
Urethane Acrylate 1	3	16000	60	Coating hardness, tensile strength, chemical resistance, non-yellowing	▪	▪	▪
Urethane Acrylate 2	3	3250	60	Coating hardness, tensile strength, adhesion, non-yellowing		▪	▪
Urethane Acrylate 3	2	12000	25	Ease of handling, scratch resistance, flexibility, impact resistance, adhesion, non-yellowing	▪	▪	▪
Urethane Acrylate 4	3	29500	25	Adhesion, chemical resistance, flexibility, scratch resistance, non-yellowing		▪	▪
Urethane Acrylate 5	2	3000	60	Adhesion, flexibility and non-yellowing	▪	▪	▪
Urethane Acrylate 6	2,5	1400	60	Coating hardness, abrasion & scratch resistance, stain resistance		▪	▪

\* Disclaimer: The information in this overview is presented in good faith and believed to be correct, but is provided on the condition that persons receiving it will make their own assessment on its correctness referring to the latest version of official documentation (e.g. safety data sheet).

Regulation status can be processed where needed.

# Matte coating – Formulation & technical properties



Identity	%
Urethane Acrylate	40,0
Monomer 1	23,0
Monomer 2	12,0
Monomer 3	4,0
Slip and levelling	0,4
Wetting agent	2,0
Matting agent	14,0
Wax	1,0
Dispersing Agent	0,2
Photoinitiator 1	2,6
Photoinitiator 2	0,8

Gloss conditions: use BYK gloss meter to measure the gloss and record the average of three measures at 60°.

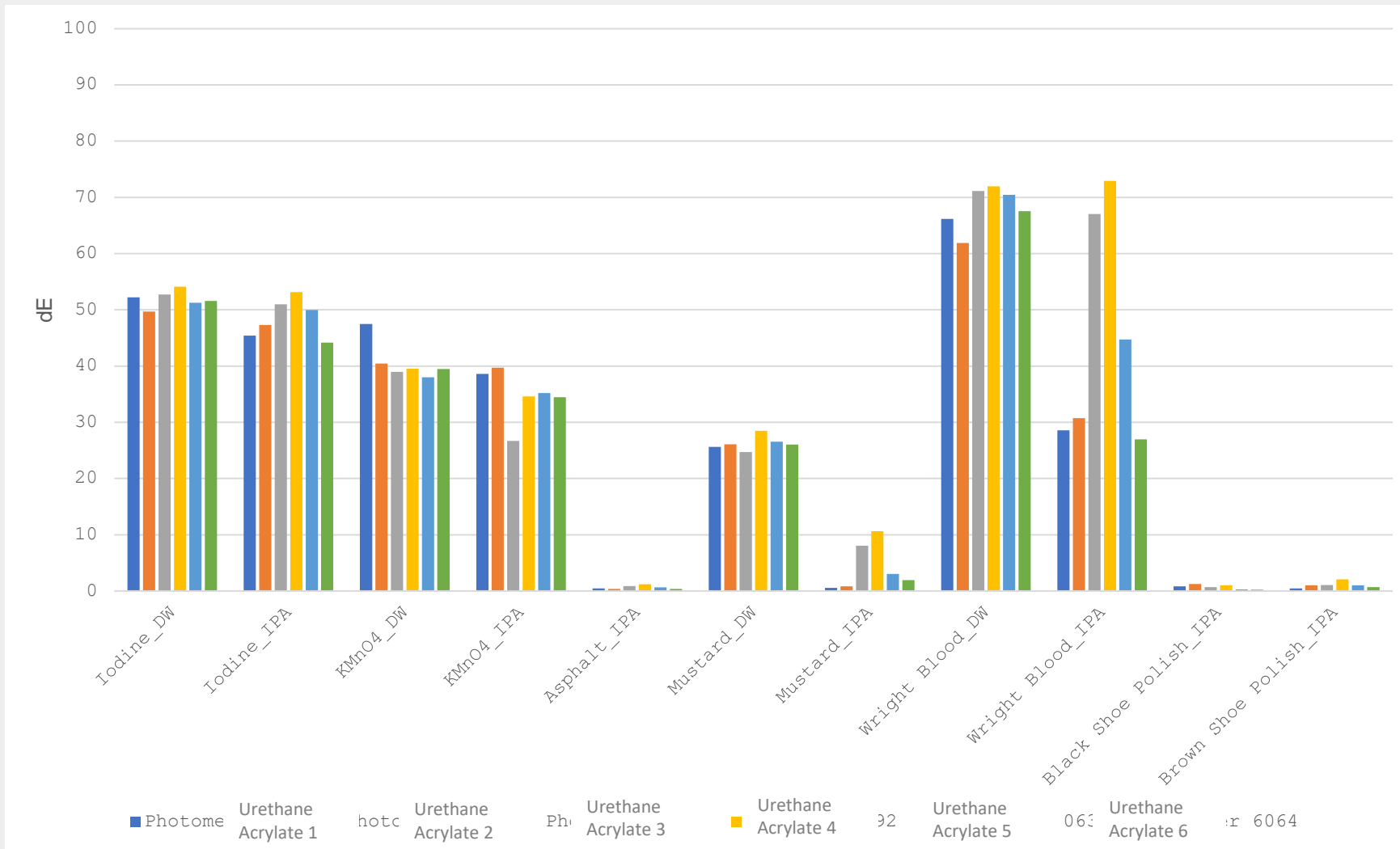
Hardness conditions: Cured recipes on clear glass substrates. König Pendulum cycles: count and record the sway cycles for each sample

Product	Viscosity at 25°C   mpa.s	Gloss at 60°	Pendulum Hardness
Urethane Acrylate 1	3660	22	80
Urethane Acrylate 2	1600	15	100
Urethane Acrylate 3	1800	11	25
Urethane Acrylate 4	2500	19	30
Urethane Acrylate 5	2300	13	50
Urethane Acrylate 6	1400	12	70





# Matte coating – Stain & Chemical resistance



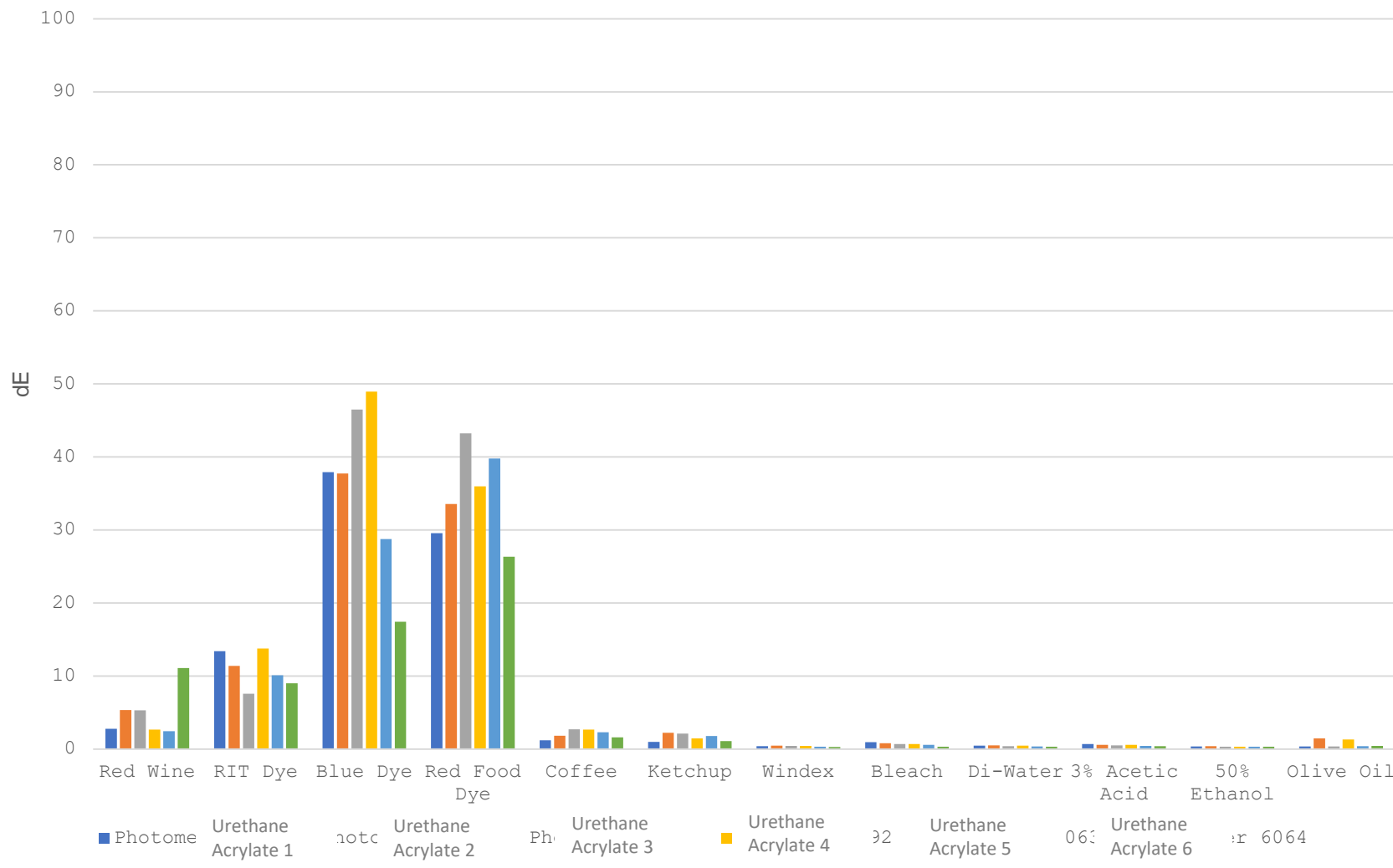
Formula samples were drawn down on white Leneta Charts with wire rod #3 (a film thickness of 13-16 microns) and two drawdowns (7x11 in) for each of the formula and cured in UV Fusion System at 25-30 fpm (945 mJ/cm<sup>2</sup>).

Test Conditions: 2 hours contact time, wipe off with dry paper towels or IPA wet paper towels and check the film appearance and color difference before and after with WR-10QC Colorimeter.

Iodine (2%), 1% KMnO<sub>4</sub>, BHMR (black), BHMR (brown), Mustard, Wright Blood, Asphalt.

- Good resistance to aggressive chemicals.
- Some of our Urethane Acrylates show interesting wright blood stain resistance

# Matte coating – Stain & Chemical resistance – Dry wiping



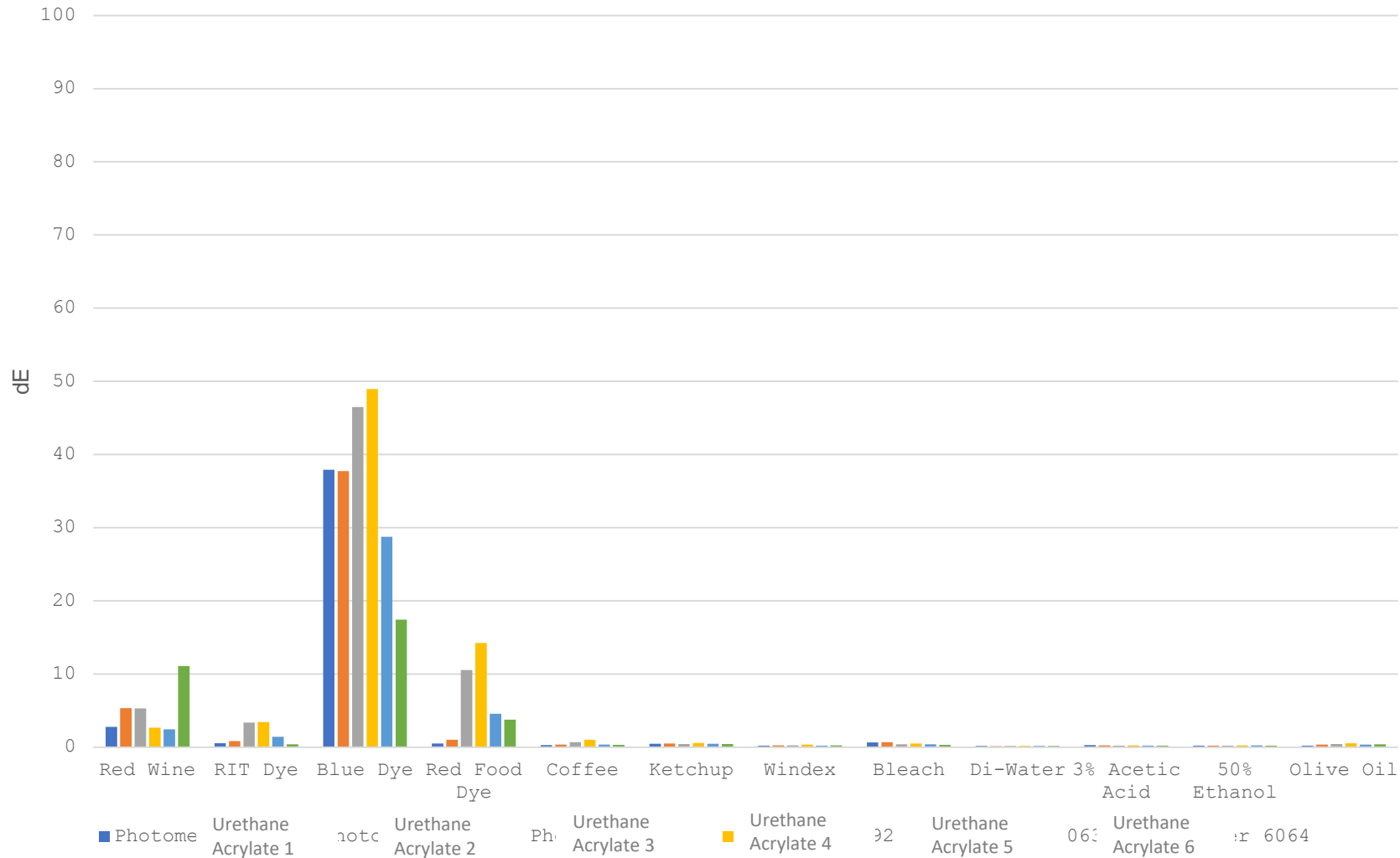
Formula samples were drawn down on white Leneta Charts with wire rod #3 (a film thickness of 13-16 microns) and two drawdowns (7x11 in) for each of the formula and cured in UV Fusion System at 25-30 fpm (945 mJ/cm<sup>2</sup>).

Test Conditions: 2 hours contact time, wipe off with dry paper towels and check the film appearance and color difference before and after with WR-10QC Colormeter.

- Good resistance to aggressive chemicals.
- No visible stain after dry wipe for coffee, ketchup, windex, bleach, di-water, acetic acid, olive oil.



# Matte coating – Stain & Chemical resistance – IPA wiping

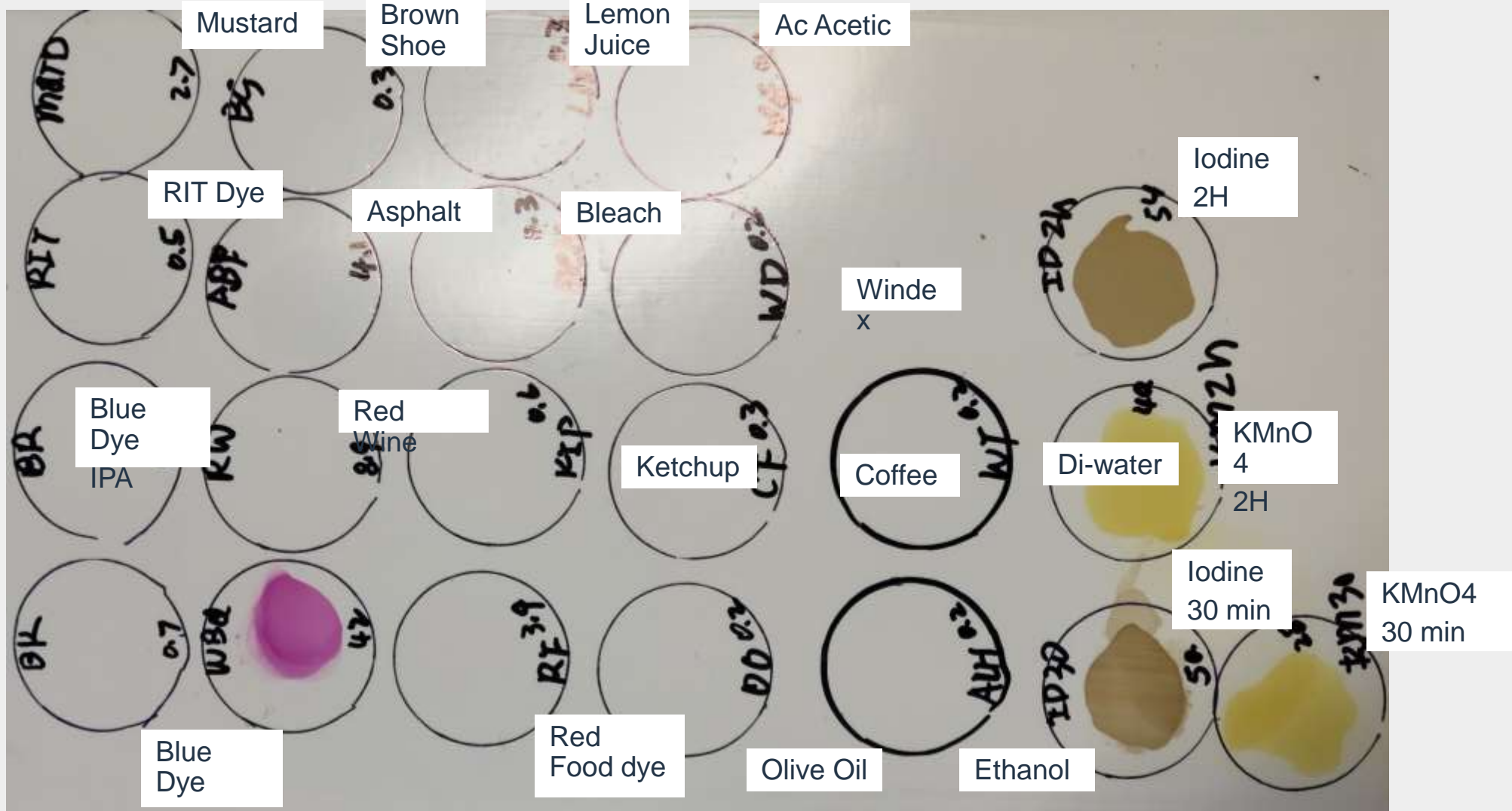


Formula samples were drawn down on white Leneta Charts with wire rod #3 (a film thickness of 13-16 microns) and two drawdowns (7x11 in) for each of the formula and cured in UV Fusion System at 25-30 fpm (945 mJ/cm<sup>2</sup>).

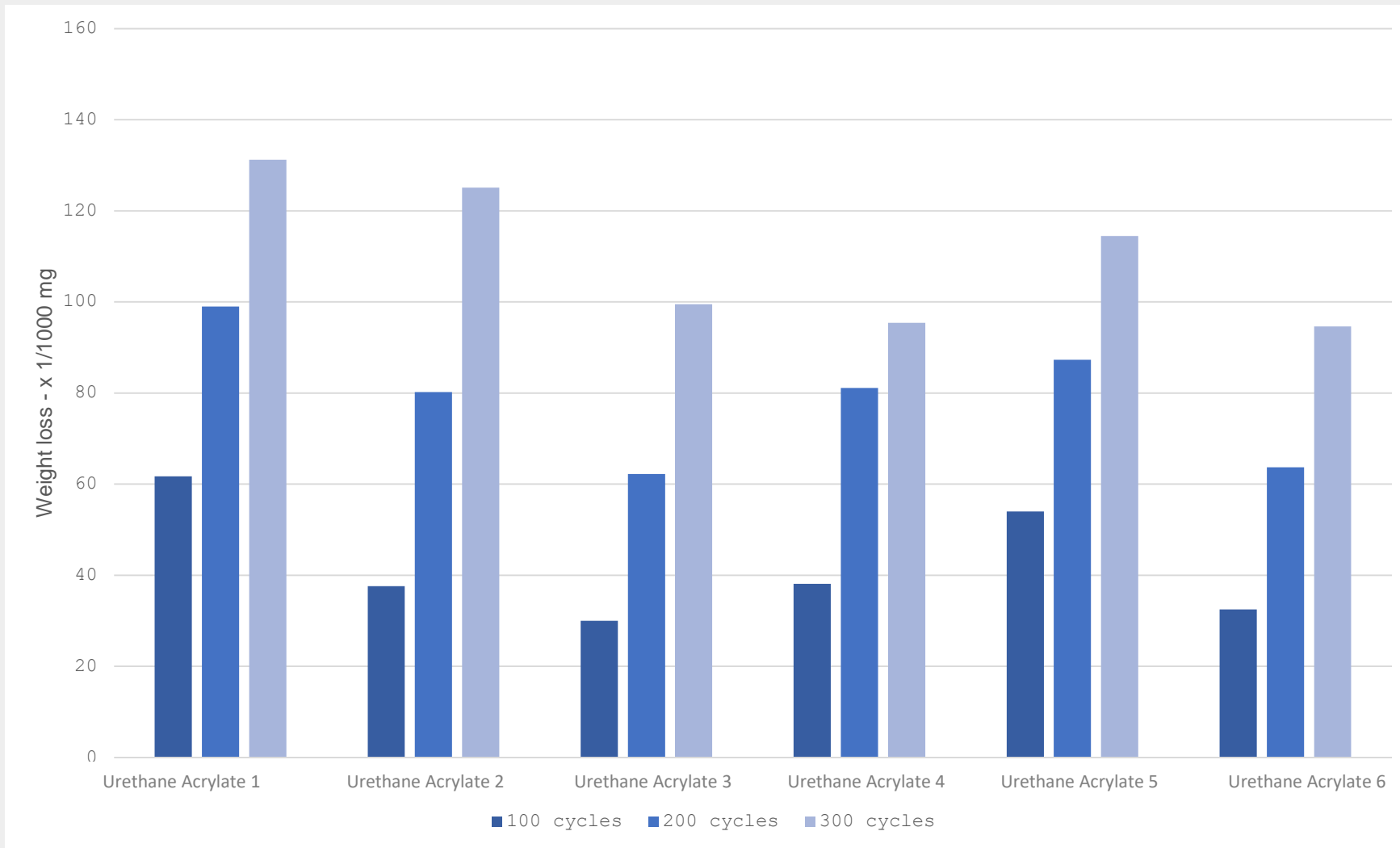
Test Conditions: 2 hours contact time, wipe off with IPA wet paper towels and check the film appearance and color difference before and after with WR-10QC Colormeter.

- Good resistance to aggressive chemicals.
- No visible stain after IPA wipe for coffee, ketchup, windex, bleach, di-water, acetic acid, olive oil.

# Matte coating – Stain & Chemical resistance - Example

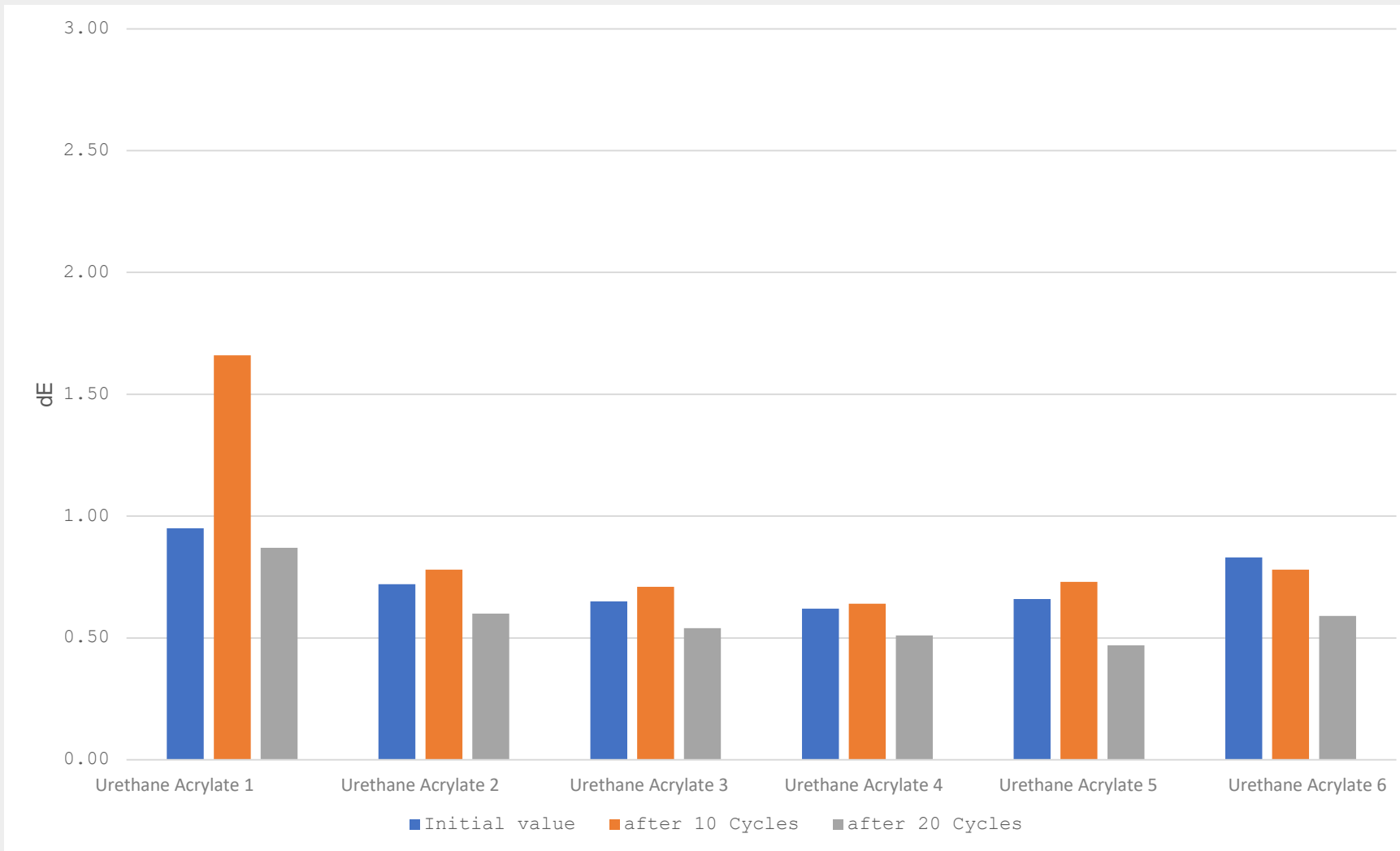


# Matte coating – Taber Abrasion resistance



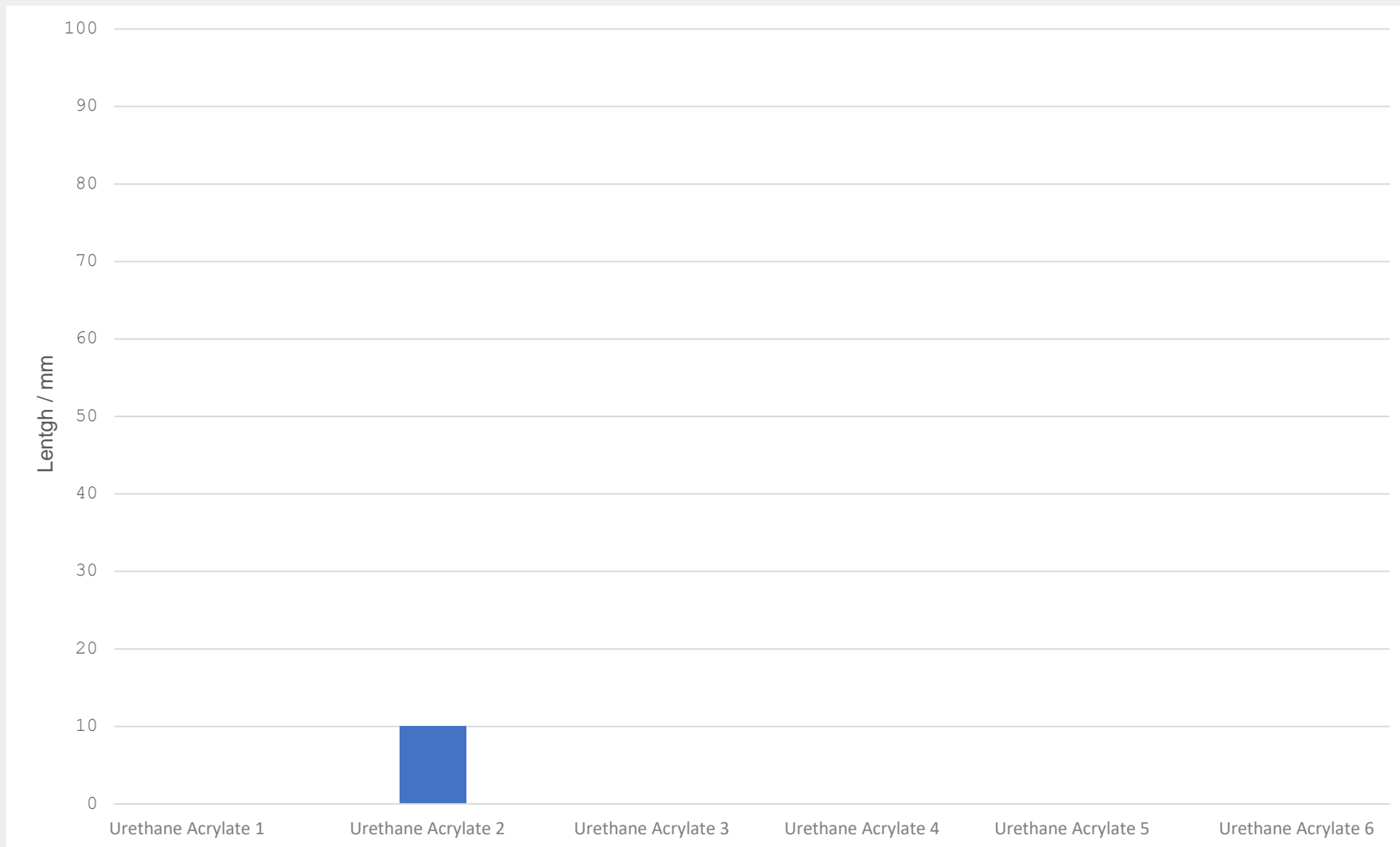
- Under strong Taber Abrasion conditions, all our products succeed.
- Some of our Urethane Acrylates show excellent abrasion resistance.

# Matte coating – UV Curing exposure test



- UV exposure have no impact on final color.
- Most of our Urethane Acrylates exhibit very low color value.

# Matte coating – Flexibility



- All products have excellent flexibility.
- Most of our Urethane Acrylates didn't show any cracks.

## In our matte formulation:

- **Stain & Chemical resistance:** All our Photomer selected for this study have excellent stain and chemical resistance.
- **Taber Abrasion resistance:** IGM Resins provides Urethanes Acrylates with excellent abrasion resistance.
- **UV Curing exposure test:** IGM Resins provides Urethanes Acrylates with very low color value.
- **Flexibility:** IGM Resins provides Urethanes Acrylates which didn't show any cracks.

*« With this study, our technical capabilities , our knowledge and our wide product range (Monomers, oligomers, photoinitiators and additives) we are deeply involved in bringing customers adapted solutions for specific market and products. »*





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Urethane Acrylate 1

Urethane Acrylate 2

Urethane Acrylate 3

Urethane Acrylate 4

Urethane Acrylate 5

Urethane Acrylate 6





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