



Benchmarking Study on Peelable Coatings

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Which peelable coatings are best suited to extend the lifespan of interior products?

As discussed in an [earlier blog](#), our Circular Project [Peeldesign](#), aims to develop innovative, removable coatings that have the potential to significantly extend the lifespan of interior products. As the majority of the peelable coatings are developed for very short use in shielding of spray cabinet walls or floors and windows during renovations, a required step in this project is to evaluate the commercially available peelable coatings that have the most promising aspects for a functional use in interior products. For this assessment, an extensive benchmarking study on a preselection of fourteen coatings analysed following key performance criteria.

This blog first highlights the key findings of the individual tests. A consolidated review of all test results and the overall conclusions are presented at the end of the article.

1. [Changes in visual appearance with aging](#)

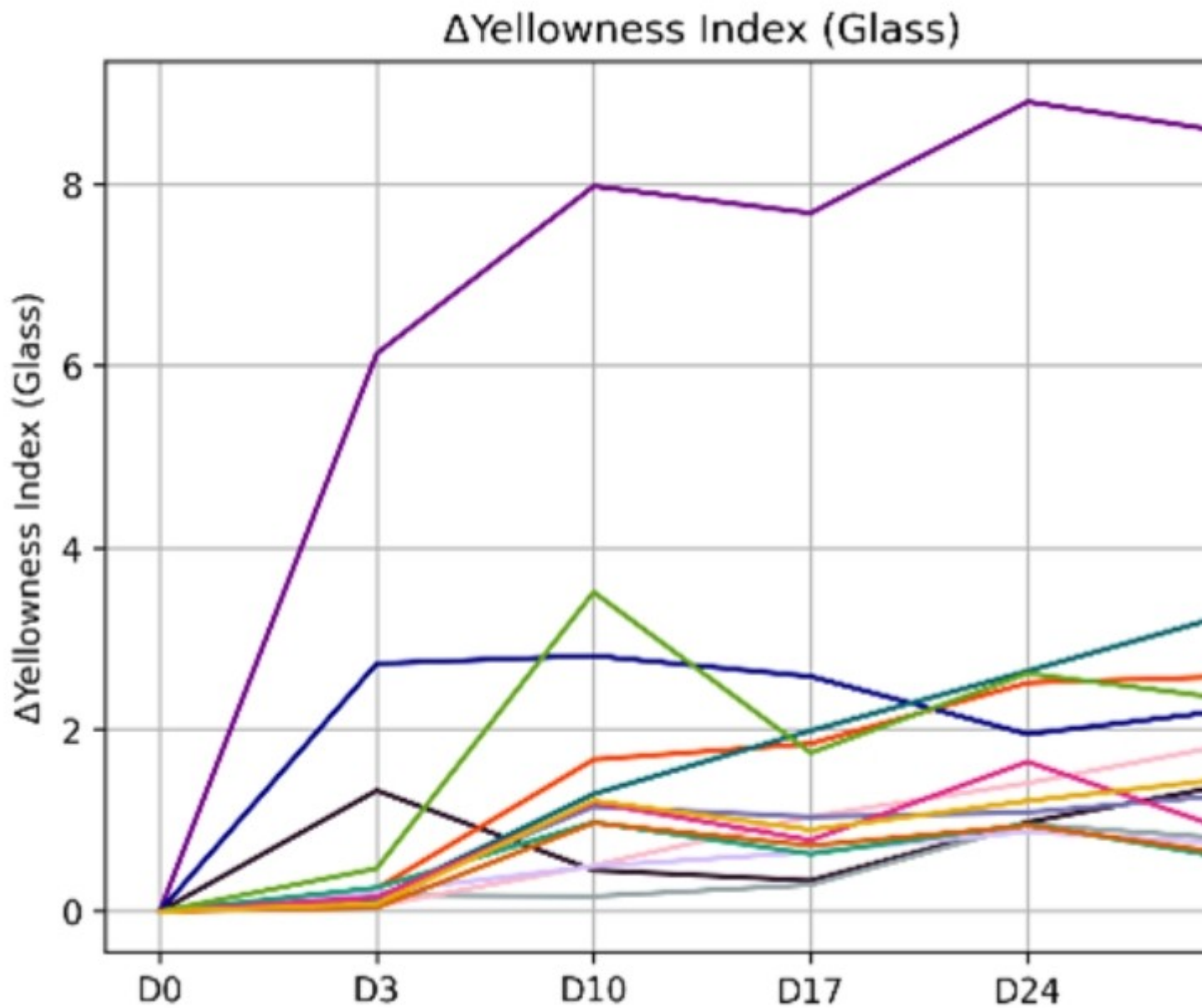
2. [Yellowing and colour change](#)
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Accelerated aging shows little impact on visual appearance

In order to assess the effect of aging on the peelable coatings without having to wait for months or years, we have applied an accelerated aging process on a selected set of coatings. Part of the samples underwent aging through [UV exposure](#) for three days and [accelerated climatic conditions](#) for 28 days. The timings were chosen taking into account the focus on interior applications for which UV exposure and climatic changes are limited. Throughout the aging process, visual appearance and surface durability were evaluated from tests on colour stability, gloss retention, light transmittance and scratch resistance.

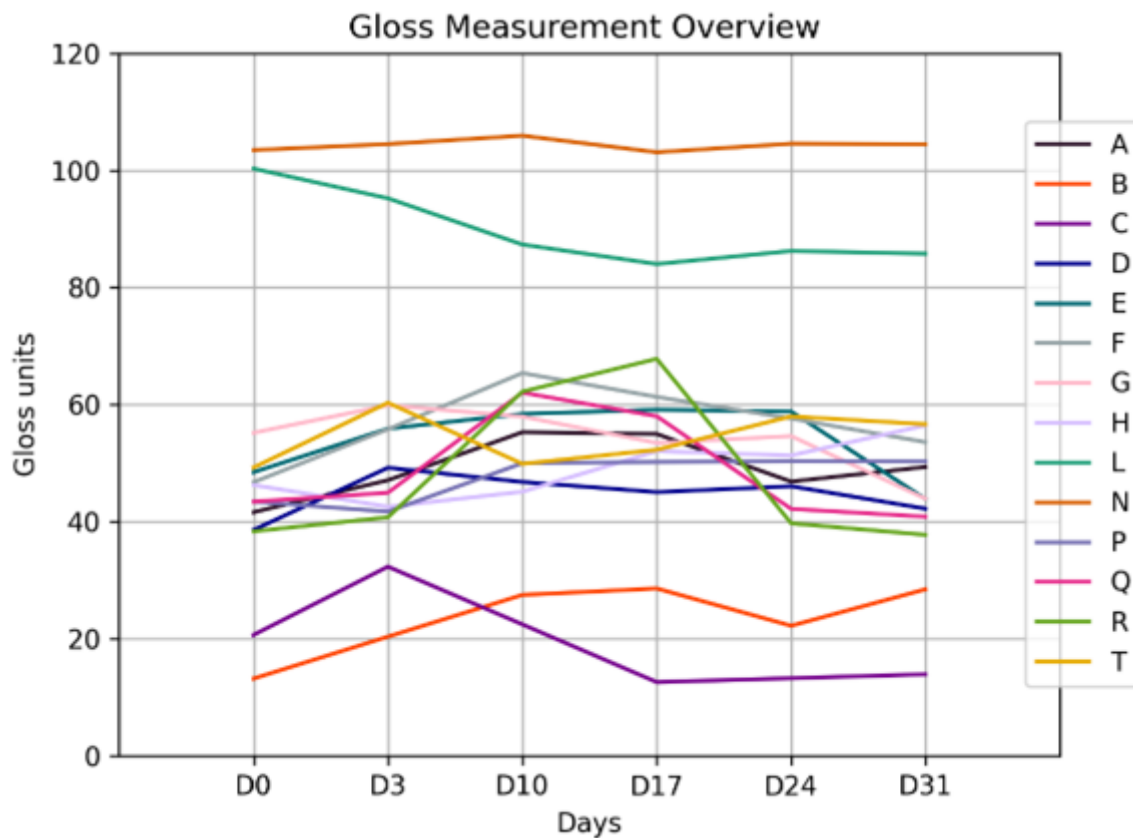
Minimal yellowing and colour change

The **colour stability** of the coatings was assessed using the [Yellowness Index \(\$\Delta YI\$ \)](#), which measures yellowing and Delta E (ΔE), which quantifies the overall colour shift as the geometric distance between two points in the CIE Lab colour space. These parameters were used to evaluate the impact of UV exposure and accelerated climatic conditions on discolouration. For most coatings, both ΔYI and ΔE values remained at or below 3, indicating minimal yellowing and colour change throughout the aging protocol. However, Coating C showed a more pronounced increase in both ΔYI and ΔE during UV exposure, suggesting early-stage photodegradation, as well as a noticeable linear colour shift across the full aging duration.



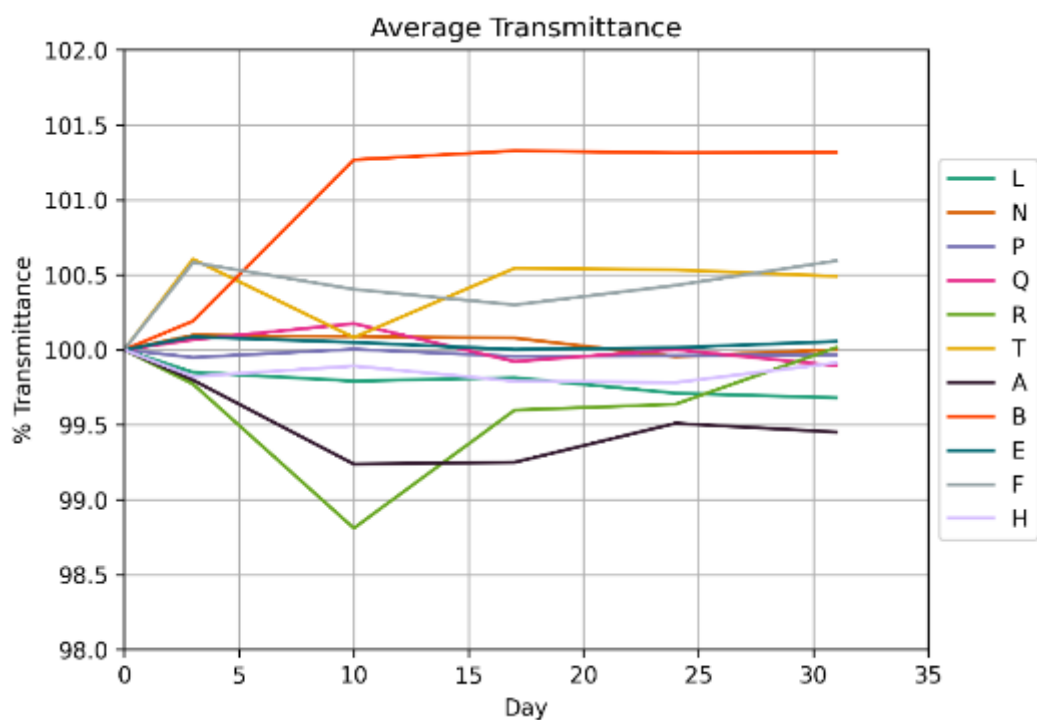
Minor impact on gloss

In cases where coatings became [slightly glossier](#), this effect was likely related to moisture absorption. Conversely, coatings that exhibited a gloss reduction likely experienced surface oxidation or related degradation processes.



Improvement and reduction in light transmittance

[Light transmittance measurements](#) were conducted for transparent coatings to evaluate changes in optical properties. Most coatings showed minimal variations, with Coating B exhibiting a slight improvement in clarity, while Coating A and L experienced a minor reduction in transmittance.



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Peel Performance: highly varied effects of aging

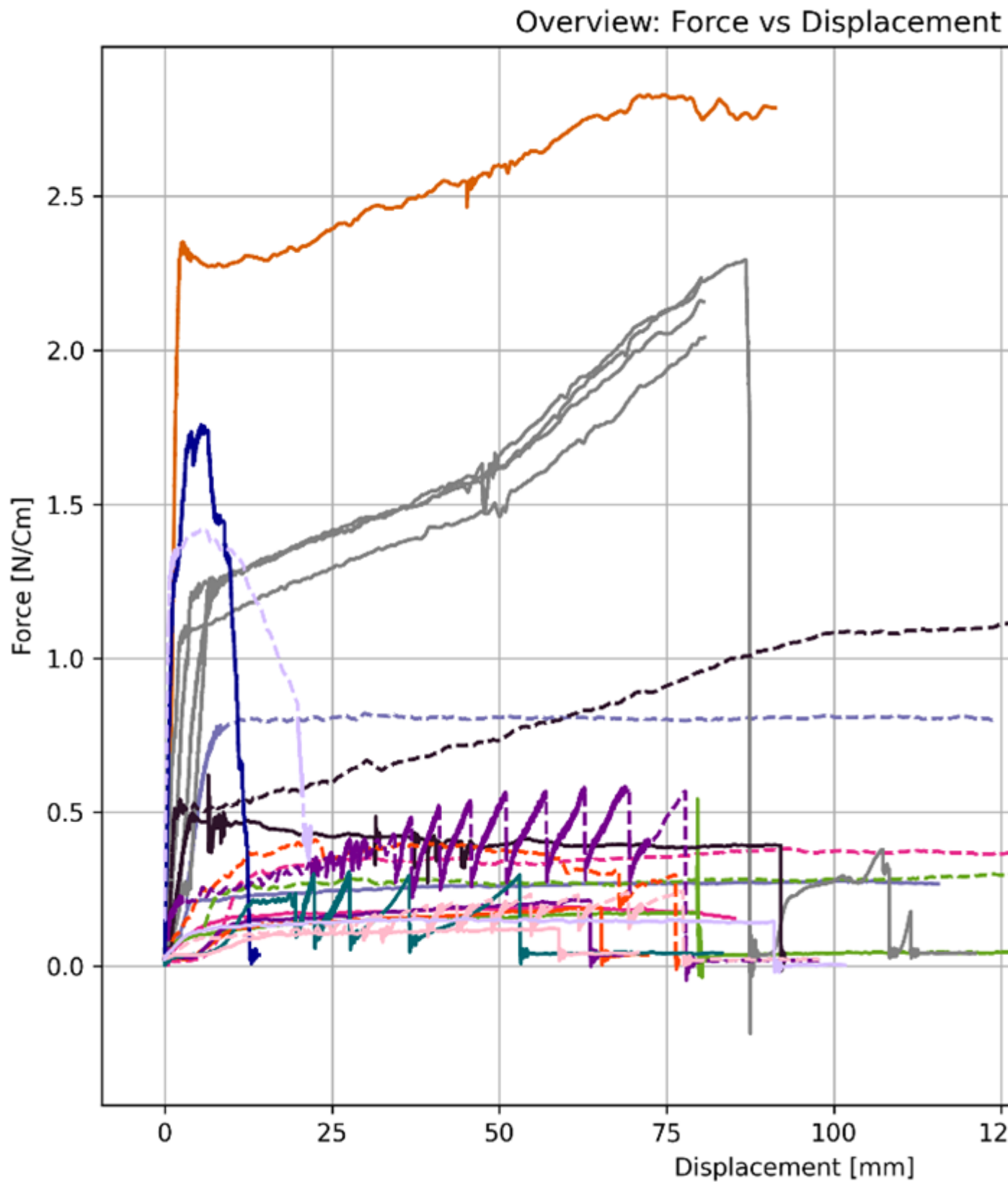


Figure 1: Graph of the force-displacement curves from peel tests performed on peelable coatings A to T and reference samples.

The above graph illustrates the force-displacement curves from [peel tests](#) performed on peelable coatings (A to T). The x-axis represents displacement (mm), while the y-axis denotes force (N/cm), measuring the resistance to detachment. Solid lines correspond to unaged samples, whereas dashed lines represent samples aged through UV exposure and accelerated climatic conditions.

Protective foil on sandwich panel as a reference

To verify the ideal adhesion strength using this testing protocol, a practical reference was selected by the project partners. Sandwich panels that are often used by the partners are delivered with a protective film applied to the surface. Removing this film requires some effort but is still manageable, making it a suitable benchmark for acceptable peelability. A sandwich panel with its original protective film was cut to the same size as the test samples and evaluated using the same peel test protocol. The resulting peel force was measured at 1.2 N/cm. Within this study, only Coating N achieved a peel force exceeding that of the reference sample, which indicates this coating would be too difficult to peel off. All other coatings demonstrated significantly lower peel force, which indicates they probably would peel off too easily.

The force pattern provides insights into peeling behaviour. A zigzag pattern suggests shock-like detachment, indicating non-uniform adhesion. In contrast, coatings with a stable force curve detach smoothly, ensuring a controlled peeling process. These variations highlight differences in adhesion strength, material integrity and resistance to aging effects.

Varying effects of aging on peel performance

In its unaged condition, **Coating A** demonstrates a relatively low (0.5 N/cm) and stable peel force, indicating controlled detachment. The displacement extends over 90 mm, meaning the coating remains intact throughout most of the peeling process. After aging, the sample exhibits no significant difference in the initial peel force, but the force gradually increases over the displacement, surpassing 150 mm. This suggests that aging increased the cohesion or increased the adhesion to the substrate to a higher value than the internal cohesion of the coating, causing the coating to elongate during peeling rather than detach cleanly.

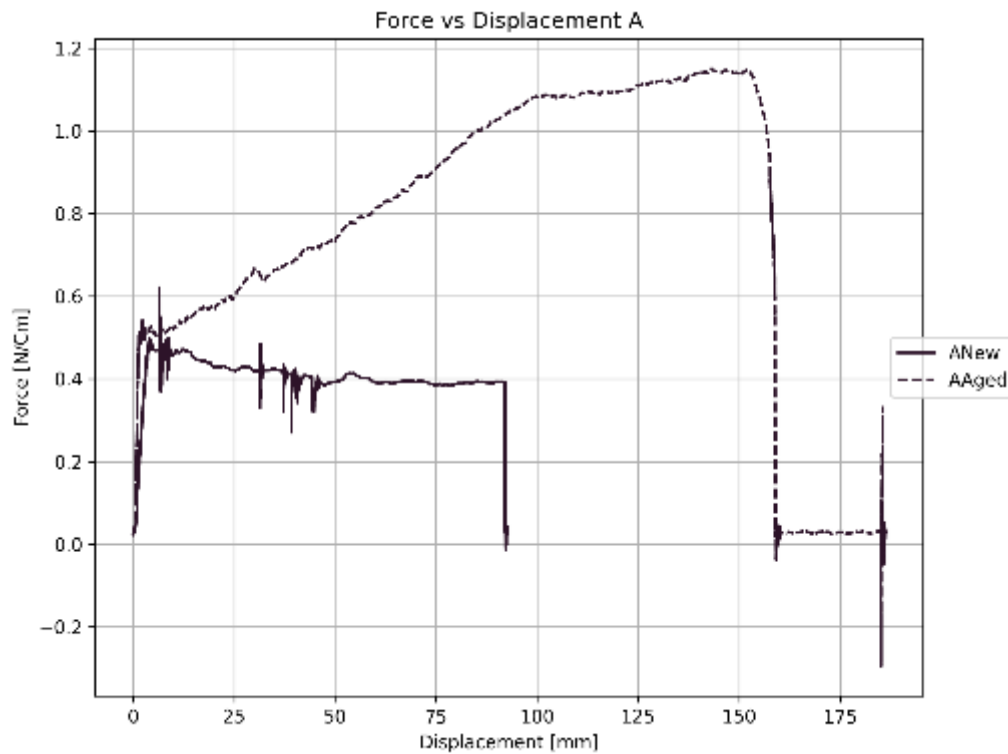


Figure 2: The force-displacement curves from peel tests performed on coating A.

Coating C exhibits distinct peeling behaviour before and after aging. The unaged sample peels smoothly with a peel force of 0.1 N/cm but ruptures at 65 mm. In contrast, the aged sample follows a zigzag pattern, indicating shock-like detachment. The peak force increases to 0.2 N/cm and failure occurs at 80 mm, suggesting that aging enhances adhesion while also increasing stiffness, leading to an irregular peeling pattern.

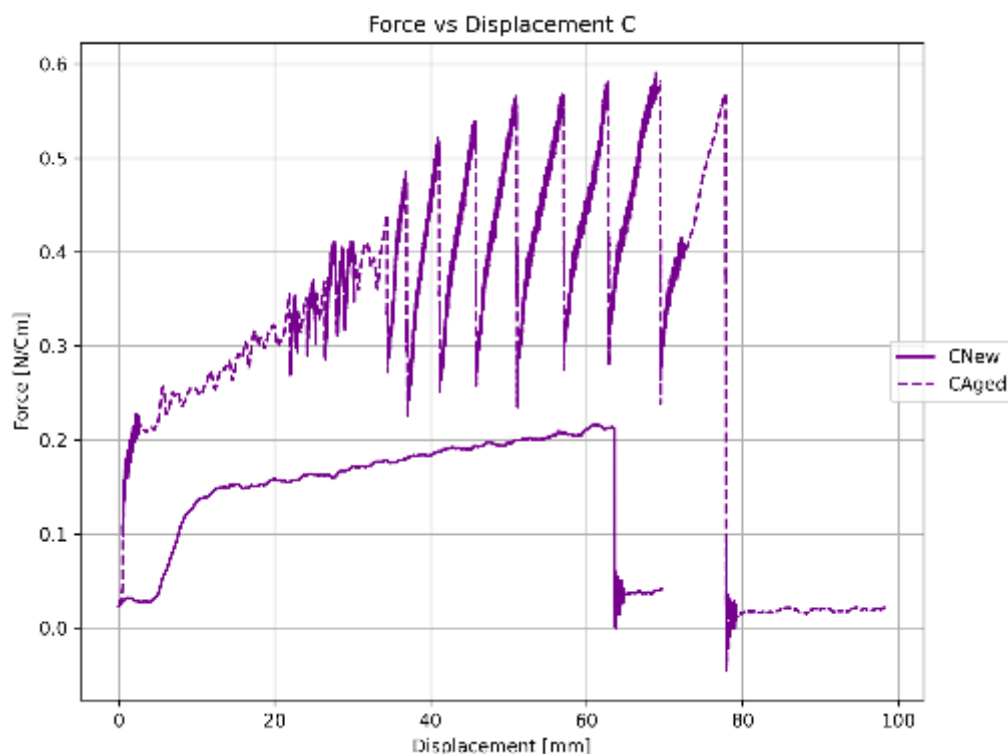


Figure 3: The force-displacement curves from peel tests performed on coating C.

Coating D shows a high initial peel force exceeding 1.4 N/cm but fails almost immediately, with displacement limited to less than 20 mm. This suggests that the coating rips instead of peeling, indicating insufficient cohesion. After aging, the sample was even weaker and could not be peeled off, implying significant degradation due to UV exposure and climatic aging.

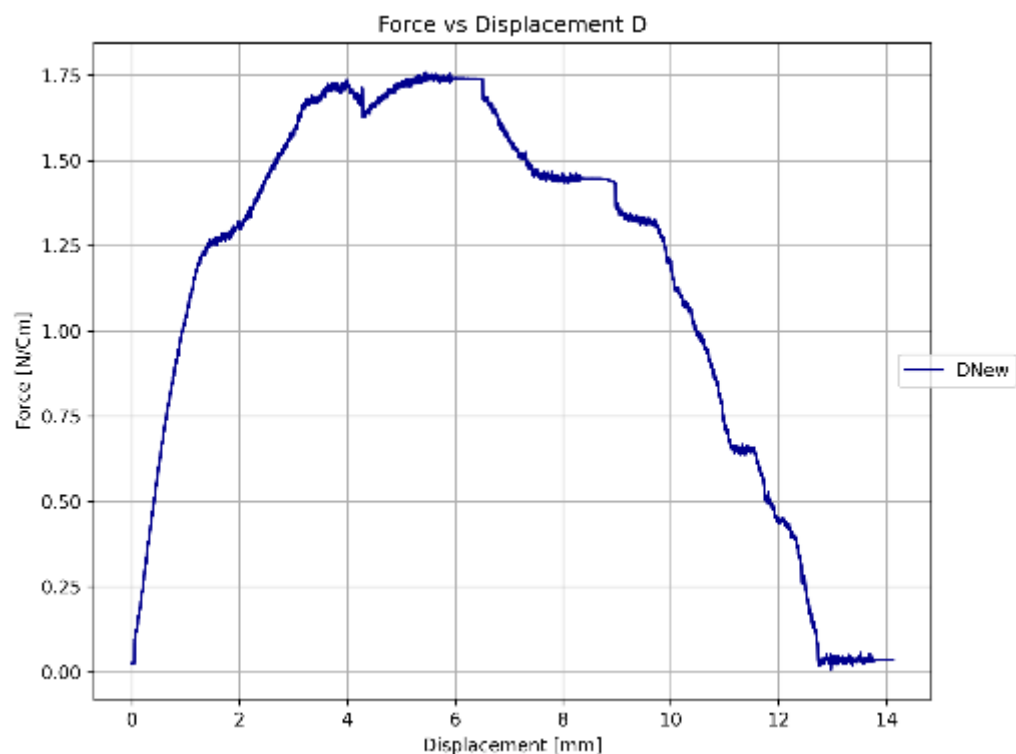


Figure 4: The force-displacement curve from peel test performed on coating D.

Coating H exhibits a low (0.1 N/cm) and stable peel force in the unaged condition, suggesting controlled detachment. However, after aging, the peel force increases significantly, while displacement is limited to 20 mm. This indicates that aging caused embrittlement, increasing adhesion strength but reducing flexibility, ultimately leading to premature failure during peeling.

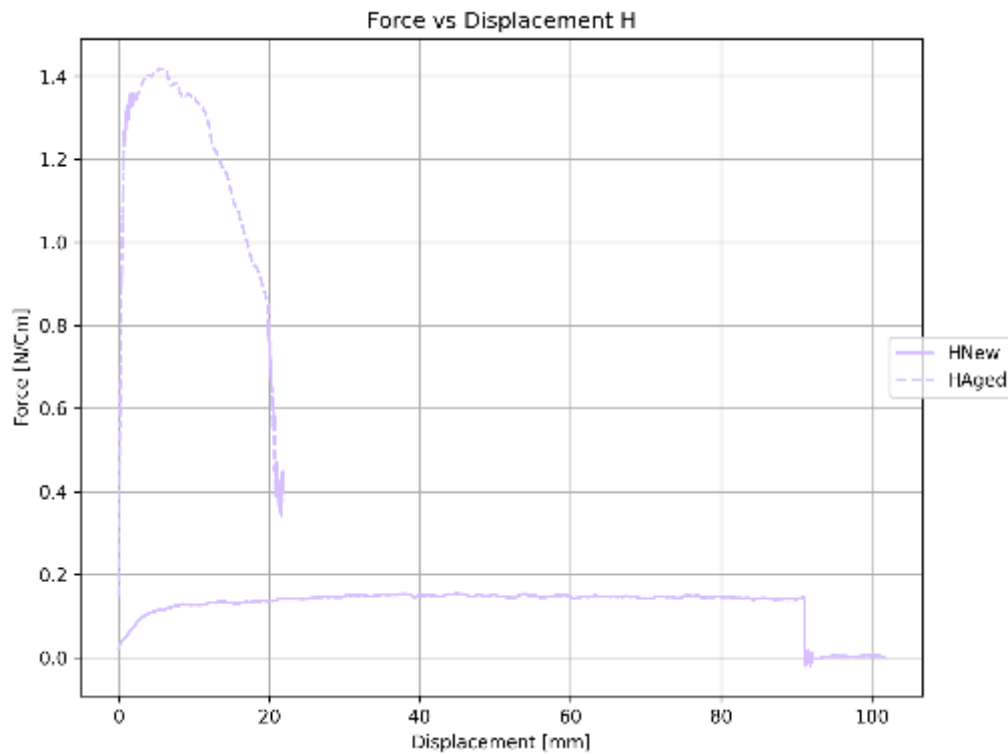


Figure 5: The force-displacement curves from peel tests performed on coating H.

For Coating F, it was not possible to perform the peel force test, as the coating was too weak to withstand initial handling. Attempting to mount the sample in the testing device resulted in rupture of the coating before the test could begin.

Conversely, the **L samples** and the **aged N sample** could also not be tested, but for the opposite reason. In these cases, the adhesion was too strong and the layer thickness at the edges was too low, making it impossible to create a starting point for the equipment to grip without damaging the substrate or coating.

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Almost impeccable overall flexibility

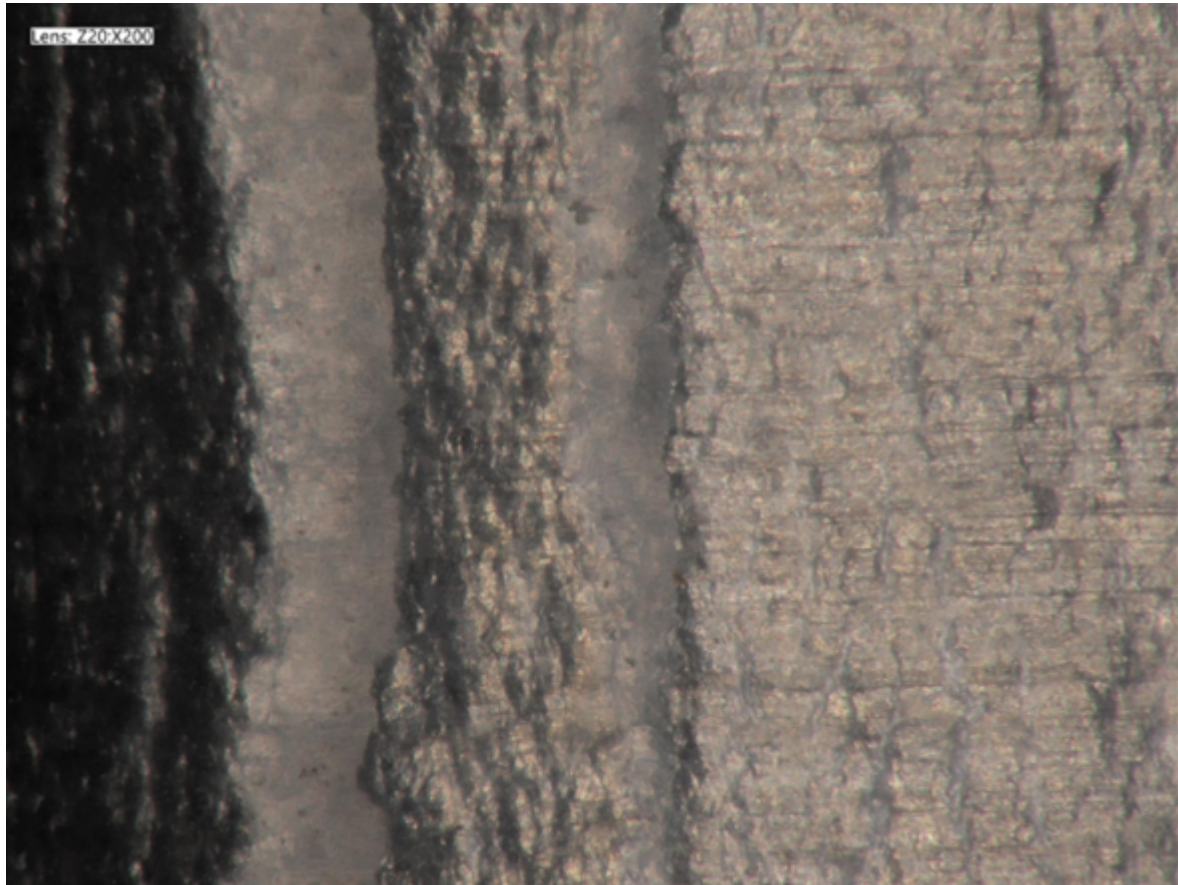


Figure 6: Microscopic images of the non-aged and aged Coating A samples show that the coating webs over the substrate crack at T0.

Flexibility was assessed using the [T-Bend Test](#), which measures a coating's ability to bend without cracking or losing adhesion. A flat, rectangular specimen is bent 360° and the resulting bend rating (Tf) indicates the number of bends that can be performed without observing any failure in the coating, such as cracking or delamination. This test was conducted on both aged and non-aged samples. Most coatings demonstrated exceptional flexibility with a T0 rating (no damage with the initial bend), having high stretchability and adhesion even when the substrate cracked. However, **Coating D** exhibited minor cracking at the tightest bend, receiving a T1 rating, indicating slightly lower flexibility.

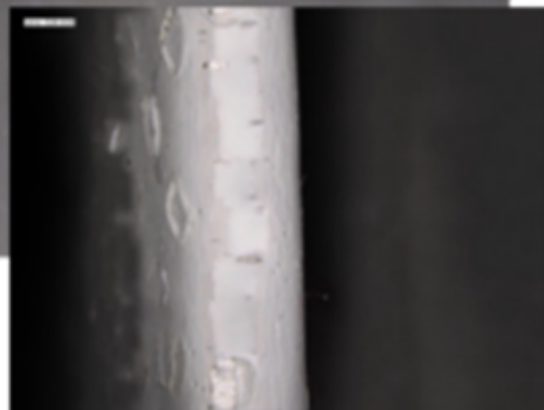
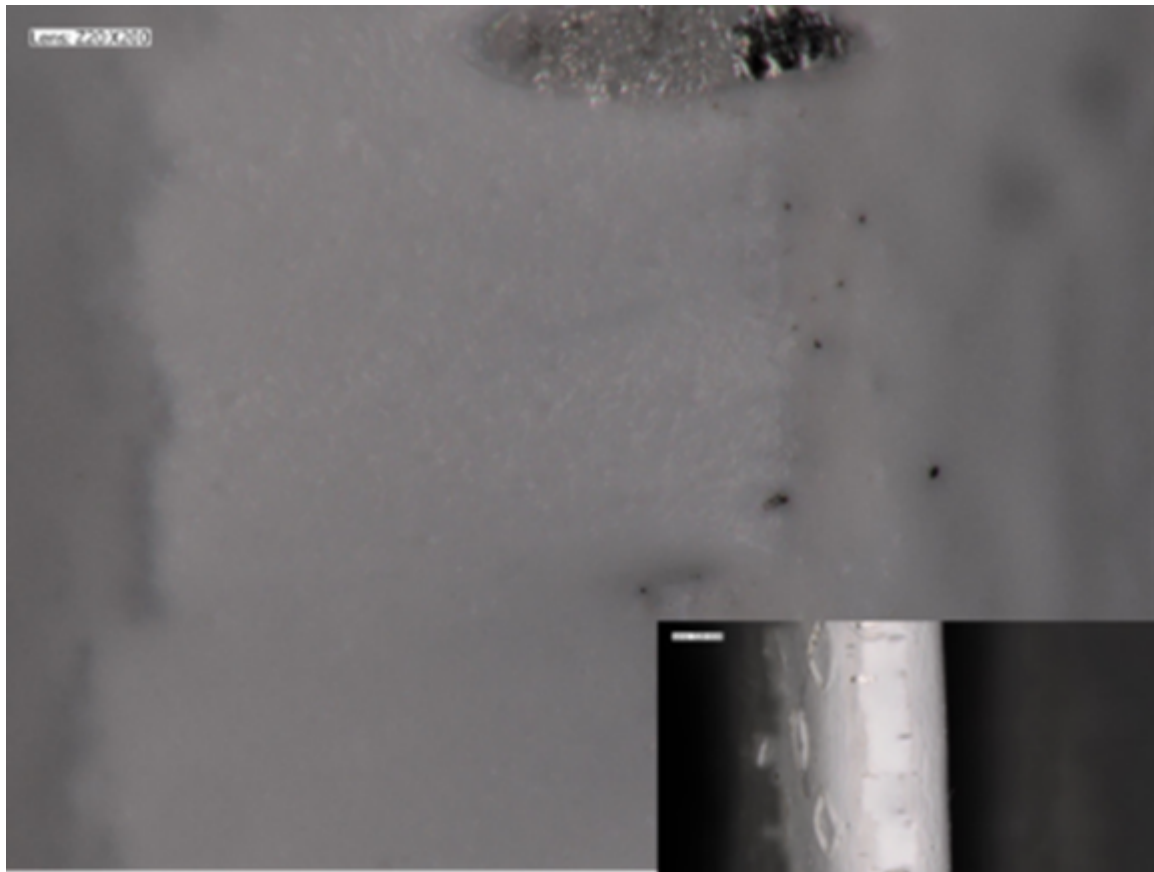


Figure 7: Microscopic images of the non-aged and aged Coating D samples show that the coating rips at T0.

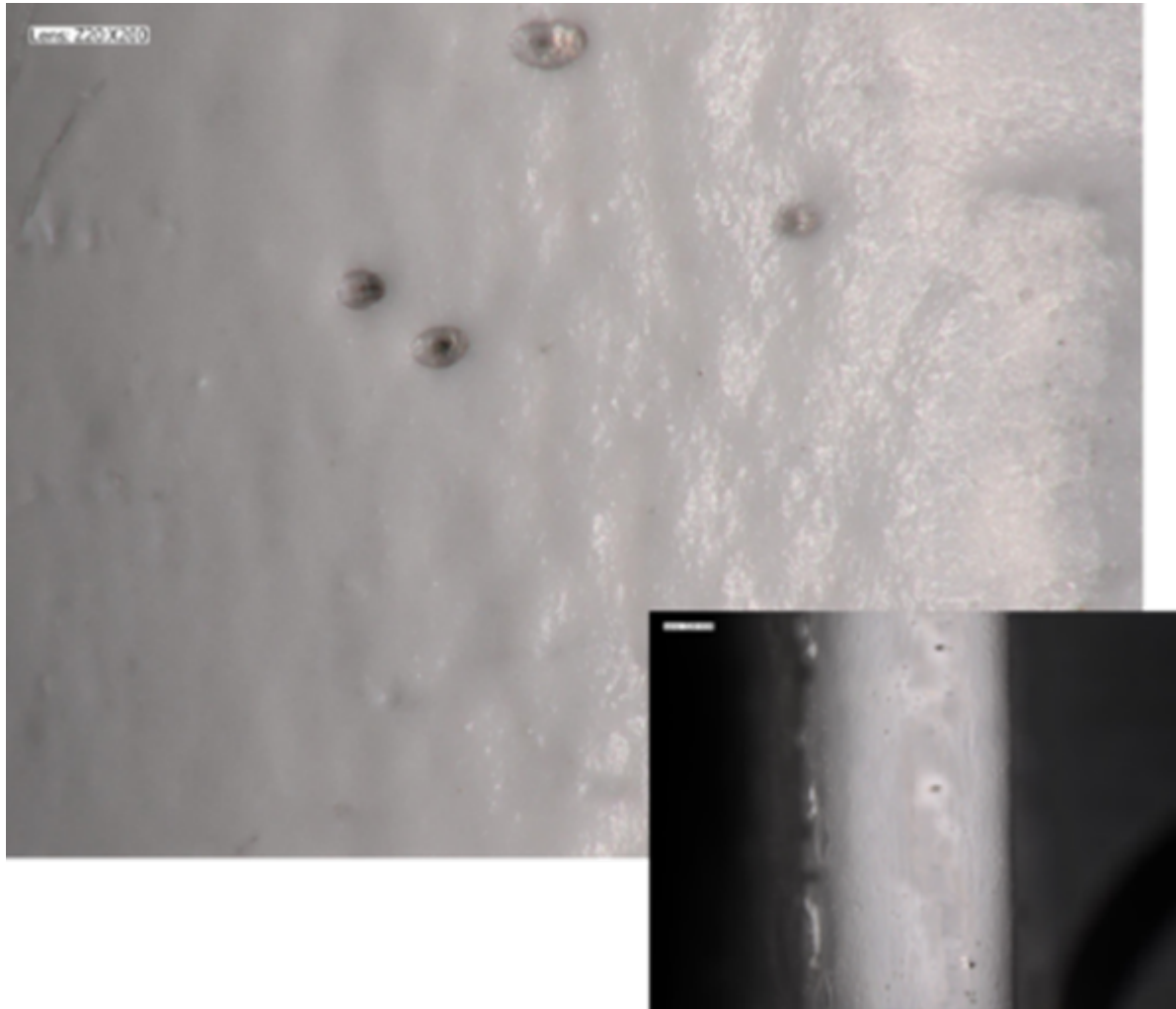


Figure 8: Microscopic images of the non-aged and aged Coating D samples show that the coating stays intact at T1.

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Scratch and abrasion resistance increase over time

Abrasion resistance: almost no adhesion failure

The [abrasion resistance](#) of the coatings was evaluated to determine their ability to withstand mechanical wear and maintain adhesion under repeated friction. Both aged and non-aged samples were tested using a standardized process in which a linear abrader applied controlled mechanical force (approximately 3,4N) to the surface. Notable differences were observed between aged and non-aged samples. During testing, fiber-like fragments from the abrader accumulated on the coating surface, which was a result of the increased stiffness of aged coatings, causing greater friction and stress on the abrader material. Despite this, most coatings displayed only visible wear marks along the abrasion track without adhesion failure, remaining firmly bonded to the substrate. The only exception was **Coating G**, which exhibited a minor adhesion defect after abrasion, suggesting slightly reduced adhesion strength.

Increased scratch resistance

Scratch resistance was assessed on both aged and non-aged samples to evaluate the [effect of aging on surface hardness and durability](#). The test involved applying a controlled force, based on the minimum required to produce a visible scratch on the non-aged sample, using a precision tool. The same force was then applied to the aged sample for direct comparison. Across all coatings, scratches were less pronounced after aging, indicating increased hardness or stiffness over time. This behaviour suggests that UV radiation and accelerated climatic conditions induce structural changes. While these changes enhance scratch resistance, they may also contribute to greater brittleness over time. Microscopic analysis of **Coating P** illustrates this trend: the non-aged sample exhibited visible delamination around the scratch, whereas the aged sample showed no delamination, reflecting improved surface integrity after aging.

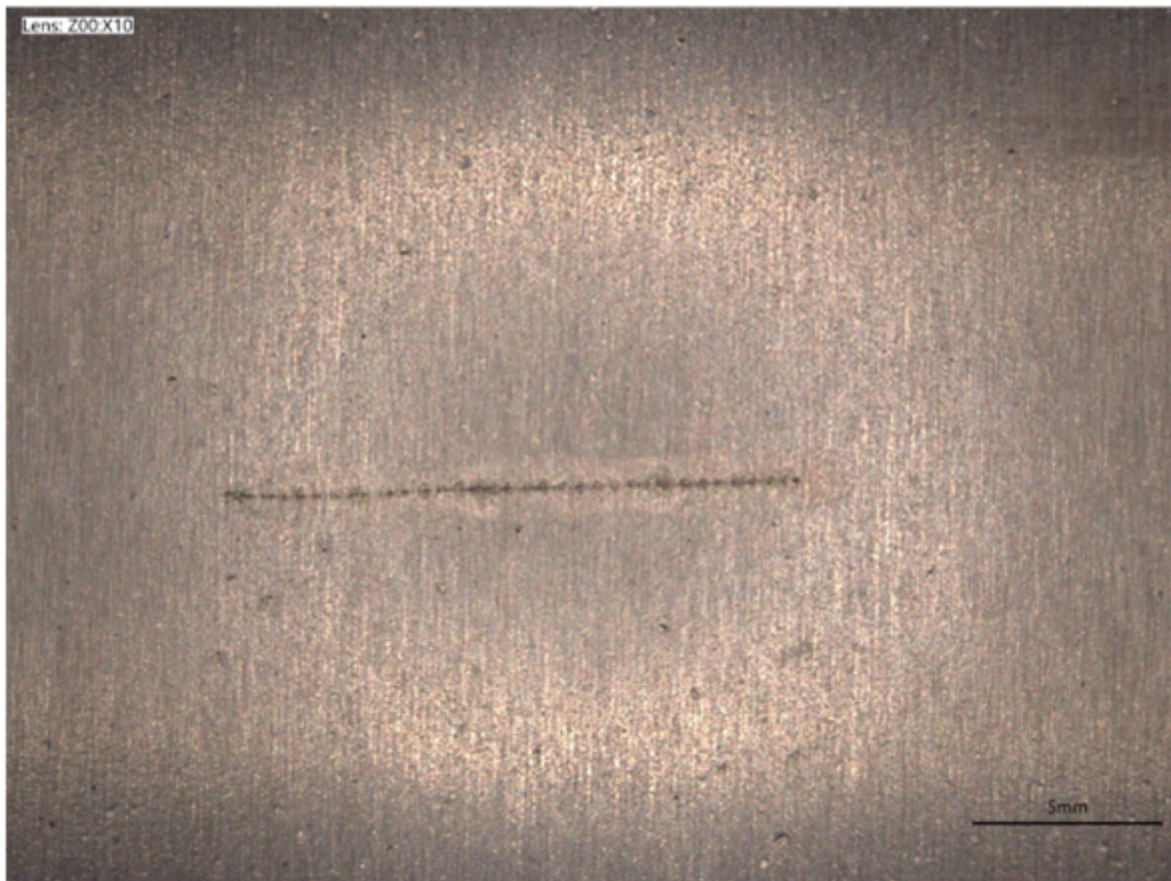


Figure 9: Microscopic images of the scratch on the non-aged and aged Coating P samples.

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Chemical resistance: water is most impactful agent of (reversible) change

The [chemical resistance](#) of the coatings was evaluated to assess their ability to withstand exposure to different products. The test involved applying three different substances: body lotion, water and a cleaning solution, to the coating surfaces and observing any visual or structural changes after exposure. The results indicate that they were primarily affected by water.

Reversible to no effect on most coatings

Most coatings exhibited some degree of interaction with water, though the severity varied. **Coatings L and N** showed no visible effect upon exposure. In contrast, the other coatings appeared to "dissolve" or soften when in contact with water; however, this effect was reversible. Once the water was removed and the coatings were allowed to dry, they returned to their original state. This indicates that while these coatings may temporarily lose mechanical integrity during water exposure, they do not sustain permanent damage.

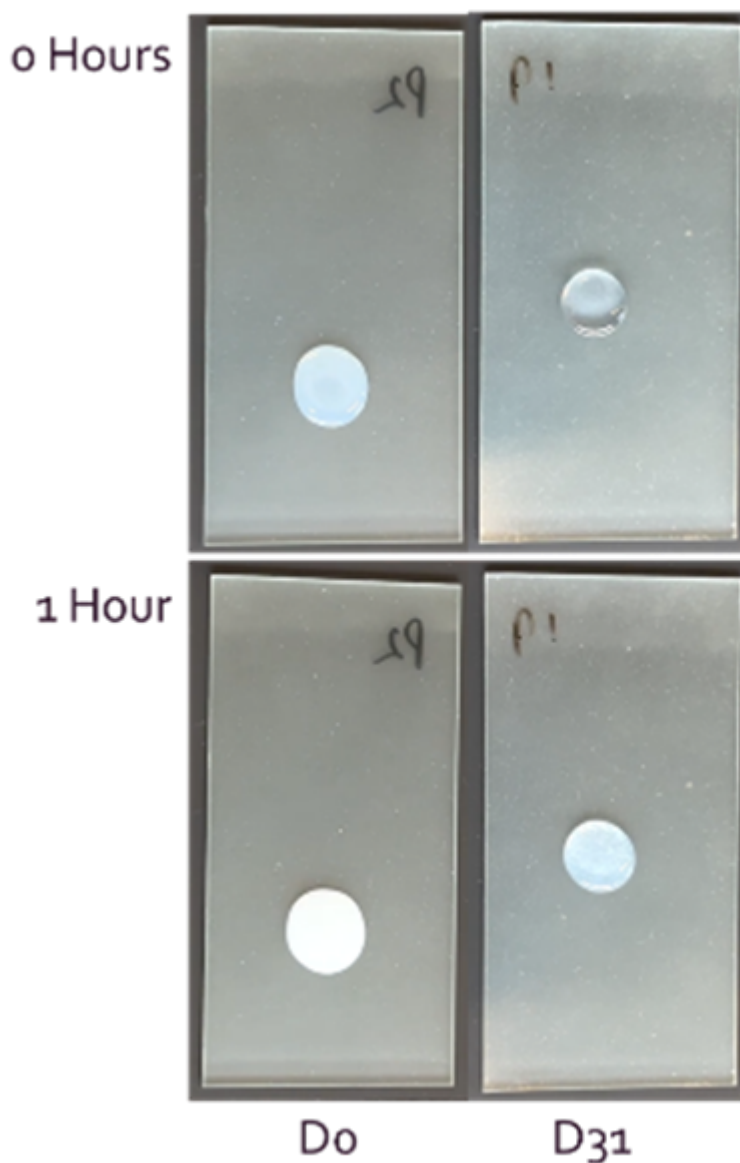


Figure 10: Photographs of the non-aged and aged Coating P samples at different time intervals during the chemical resistance test.

Irreversible change on some coatings

Coatings E to H underwent irreversible changes upon water exposure, showing visible damage to the coating surface that persisted even after drying. This indicates poor water resistance and suggests structural degradation of the coating material, confirming its inability to recover following contact with water.

Test results

The table below shows an overview of all results, comparing the different peelable coatings (labelled A to T) on a range of technical performance parameters. Each column represents a different coating, while the rows correspond to the specific samples and the test parameters assessing adhesion, flexibility, durability and surface appearance changes. Grey marked rows give the results for aged samples. For Abrasion, Scratch and Chemical resistance tests, results are given a score between 0 and 3, meaning:

- 0= No visual damages
- 1= Minimal damages
- 2= Damages
- 3= Significant damages

Code	A	B	C	D	E	F	G	H	L	N	P	Q	R	T
Peel force (N/cm)	0,49	0,12	0,14	1,72	0,20	-	0,10	0,11	-	2,35	0,2	0,16	0,10	0,15
	0,51	0,25	0,22	-	-	-	0,09	1,42	-	-	0,8	0,35	0,30	0,25
Bending	T0	T0	T0	T1	T0	T0	T0	T0	T0	T0	T0	T0	T0	T0
	T0	T0	T0	T1	T0	T0	T0	T0	T0	T0	T0	T0	T0	T0
Abrasion ¹	1	1	1	2	2	2	3	1	1	1	2	2	2	2
	2	2	2	2	2	2	2	2	1	1	2	2	2	2
Color (ΔYI)	1,4	2,6	8,5	2,2	3,3	0,8	1,9	0,7	0,6	0,6	1,3	0,8	2,3	1,5
Color (ΔE)	2,4	1,3	6,0	2,1	2,6	0,7	2,0	0,8	2,4	0,9	1,3	0,6	1,7	1,5
Gloss (ΔGU%)	-19%	-116%	33%	-9%	9%	-15%	20%	-22%	14%	-1%	-16%	6%	2%	-15%
Scratch (N)	1	1	1	1	1	5	1	5	5	5	3	3	3	3
Scratch D0 ¹	1	2	1	2	3	3	3	2	1	1	2	3	3	3
Scratch D31 ¹	0	1	0	1	0	1	2	2	1	1	1	2	1	1
Transmittance (%)	76	85	NA	NA	89	89	NA	87	89	90	84	88	86	87
Transmittance (Δ%)	0,55%	1,32%	NA	NA	0,06%	0,59%	NA	0,09%	0,32%	0,00%	0,04%	0,11%	0,01%	0,49%
Chemical resistance ¹	1	1	2	1	3	3	3	3	0	0	1	1	3	1
	2	1	2	2	3	3	3	3	0	0	0	0	1	1

Conclusion

Overall, the extensive testing shows that coatings from different suppliers generally maintain their visual appearance and flexibility under the applied aging conditions. The visual appearance doesn't deteriorate dramatically when aging, nor does the flexibility. Adhesion and scratch resistance remain high-level over the tested aging period. Only the water resistance remains a limitation, with reversible damage for some coatings and irreversible for others. And, more significantly, the peel performance test showed very different results, in type of reaction and in quality.

This led us to the following conclusion: among the tested coatings, **Coatings A, L, N and P** stand out as strong candidates for further evaluation, demonstrating some of the highest adhesion strengths and ranking among the best-performing coatings in this study.

These coatings will be the ones we take along on our BBBC Peeldesign journey. In the next phases of the project, these coatings will be further developed to refine their formulations and meet the outlined requirements. Keep following us on this exciting [journey towards product lifetime](#)

[extension](#) and more sustainable manufacturing.

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External links

All tests used in this research were carried out in our test labs. External links to the different test lab websites are listed below.

- <https://testlabs.sirris.be/tests/uv-weathering-test/>
- <https://testlabs.sirris.be/tests/climate-chamber-test/>
- <https://testlabs.sirris.be/tests/colour-measurement/>
- <https://testlabs.sirris.be/tests/gloss-measurement/>
- <https://testlabs.sirris.be/tests/measurement-of-reflection-absorption-and-transmission/>
- <https://testlabs.sirris.be/tests/tensile-test/>
- <https://testlabs.sirris.be/tests/flexural-test/>
- <https://testlabs.sirris.be/tests/taber-abraser-test/>
- <https://testlabs.sirris.be/tests/hardness-test/>
- <https://testlabs.sirris.be/tests/chemical-resistance-test/>

Care to find out more?

Even this lengthy blog is but a brief summary of the detailed findings we have generated throughout these tests. If you are interested to find out more, or would like to discuss these findings, do not hesitate to get in touch with me using the button below.

[Contact us](#)

More information on the overarching **BBBC Peeldesign project** can be found here.

[Discover the BBBC Peeldesign project](#)

Authors



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