

The logo for Hybond, featuring the word "Hybond" in a bold, red, sans-serif font. The letter 'y' has a distinctive shape with a curved bottom. To the right of the text is a grey molecular structure graphic consisting of several circles of varying sizes connected by thin lines, representing a chemical or adhesive structure.

THE ADHESIVE SPECIALISTS

HYBOND TECHNICAL SERVICE REPORT

DATE: 01-03-2022

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Hybond Technical Service Report

Overview

The client requires a battery of testing of two adhesives on an array of substrates. The two adhesives to be tested are REGUPOL 46-101 and REGUPOL 43-105. All samples will be bonded, conditioned, and tested following procedures outlined in BS EN ISO 22631:2019.

Lab test

Sample Preparation

The materials bonded can be categorised in two ways, REGUPOL and coverings. For each sample, the REGUPOL was cut into strips of 50 mm x 150 mm and the covering was cut to a width of 50 mm and a minimum length of 250 mm where possible.

The adhesive was applied to the REGUPOL strips. Before coating with adhesive, the end 25 mm of the REGUPOL strip was covered with masking tape. The trowel used had a notch width of 3 mm and a notch depth of 3 mm and a notch distance of 3 mm. Samples were bonded in sets of five. After each set the trowel was cleaned and dried and the notches were examined to ensure no damage or deformation had occurred. The adhesive was applied along the short edge of the strips with the trowel held at approximately 60° to the surface, resulting in parallel beads of adhesive running horizontally across the width of the REGUPOL strip. The masking tape was then removed. The REGUPOL was then mated to the corresponding covering and consolidated with a hand roller with a width of 77 mm and a diameter of 38 mm. Each set of five was placed in a stack, separated by a sheet of wax paper and a 1 kg weight was placed on top of each stack to maintain pressure on the bond for 24 hours while the adhesive cured.

The following table outlines the samples which were produced (Table 1, Pg. 2-3).

Substrate 1	Substrate 2	REGUPOL 46-101	REGUPOL 43-105
REGUPOL 4515 Multi	Forbo Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Multi	Miliken	Bonded	Bonded
REGUPOL 4515 Multi	Marmoleum	Bonded	Bonded
REGUPOL 4515 Multi	P5 Chipboard	Bonded	Bonded
REGUPOL 4515 Multi	Parquet	Bonded	N/A
REGUPOL 4515 Multi	Engineered Timber	Bonded	Bonded
REGUPOL 4515 Multi	Plywood	Bonded	Bonded
REGUPOL 4515 Multi	Bamboo	Bonded	Bonded
REGUPOL 4515 Multi	Gradus Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Multi	Paragon Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Multi	Amtico Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Multi	Ceramic Tiles 6 mm	Bonded	N/A
REGUPOL 4515 Multi	Porcelain Tiles 8 mm thick	Bonded	N/A
REGUPOL 4515 Multi	Marble Tiles	Bonded	N/A
REGUPOL 4515 Eco	Forbo Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Eco	Miliken	Bonded	Bonded
REGUPOL 4515 Eco	Marmoleum	Bonded	Bonded
REGUPOL 4515 Eco	P5 Chipboard	Bonded	Bonded
REGUPOL 4515 Eco	Parquet	Bonded	N/A
REGUPOL 4515 Eco	Engineered Timber	Bonded	Bonded
REGUPOL 4515 Eco	Plywood	Bonded	Bonded
REGUPOL 4515 Eco	Bamboo	Bonded	Bonded
REGUPOL 4515 Eco	Gradus Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Eco	Paragon Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Eco	Amtico Carpet Tiles	Bonded	Bonded
REGUPOL 4515 Eco	Ceramic Tiles 6 mm	Bonded	N/A
REGUPOL 4515 Eco	Porcelain Tiles 8 mm thick	Bonded	N/A
REGUPOL 4515 Eco	Marble Tiles	Bonded	N/A
REGUPOL 3912	Engineered Timber	Bonded	Bonded
REGUPOL 3912	CPB	Bonded	Bonded
REGUPOL 4515 Multi	Concrete	Bonded	Bonded
REGUPOL 4515 Eco	Concrete	Bonded	Bonded
REGUPOL 3912	Concrete	Bonded	Bonded
REGUPOL 7210 C 3 mm	Forbo Carpet Tiles	Bonded	Bonded
REGUPOL 7210 C 3 mm	Amtico Carpet Tiles	Bonded	Bonded
REGUPOL 7210 C 3 mm	Parquet	Bonded	N/A
REGUPOL 7210 C 3 mm	Engineered Timber	Bonded	Bonded
REGUPOL 7210 C 3 mm	18 mm Chipboard	Bonded	Bonded
REGUPOL 4515 Multi	STS Cementitious Board	Bonded	Bonded
REGUPOL 4515 Eco	STS Cementitious Board	Bonded	Bonded

REGUPOL 7210C	STS Cementitious Board	Bonded	Bonded
REGUPOL SH/Vibration 480	STS Cementitious Board	Bonded	Bonded
REGUPOL HT/Vibration 550	STS Cementitious Board	Bonded	Bonded
REGUPOL XHT/Vibration 800	STS Cementitious Board	Bonded	Bonded
REGUPOL MF/Vibration 1000	STS Cementitious Board	Bonded	Bonded
Soundlay Foam	STS Cementitious Board	Bonded	N/A
Soundlay Foam	STS Cementitious Board	N/A	Bonded
Soundlay Foam	Chipboard	N/A	Bonded
REGUPOL SH/Vibration 480	REGUPOL SH/Vibration 480	N/A	Bonded
REGUPOL SH/Vibration 480	40/80	N/A	Bonded
REGUPOL SH/Vibration 480	High Impact Mat	N/A	Bonded
REGUPOL SH/Vibration 480	Concrete	N/A	Bonded
REGUPOL Impact Mat	Cementitious Board	N/A	Bonded
REGUPOL Impact Mat	Everoll	N/A	Bonded
Regufoam	High Impact Mat	N/A	Bonded
Regufoam	STS Cementitious Board	N/A	Bonded
REGUPOL 4515 Multi	Tarkett	Bonded	N/A
REGUPOL 4515 Multi	Quickstep Lyvin	Bonded	Bonded
REGUPOL 4515 Multi	Tarkett LVT	Bonded	Bonded
REGUPOL 4515 Multi	Karndean LVT (1)*	Bonded	Bonded
REGUPOL 4515 Multi	Unilin Pergo Laminate	Bonded	Bonded
REGUPOL 7210C	Ceramic Tile	Bonded	Bonded
Everoll	Concrete	Bonded	N/A
REGUPOL 4515 Multi	Amtico LVT	Bonded	Bonded
REGUPOL 4515 Eco	Amtico LVT	Bonded	Bonded
REGUPOL 4515 Muti	Karndean LVT (2)*	Bonded	Bonded
REGUPOL 4515 Eco	Karndean LVT	Bonded	Bonded

Table 1 - Table showing list of all samples bonded

* Karndean LVT test was repeated with REGUPOL 4515 Multi. The tests were carried out following identical procedures, numbers used to differentiate the two tests.

Climate and Peel Testing

All the samples were given a minimum of 7 days to fully cure before peel testing was carried out. Peel testing was carried out using an Alphas Tensometer by placing the sample in a floating roller conforming to specifications outlined in BS EN ISO 22631:2019, 5.5 Peeling Device. Before peel testing could be carried out a 40 mm strip of the REGUPOL is required to be unbonded, therefore where possible this was peeled back by hand using strips of wood to ensure uniform pressure across the entire width of the REGUPOL. Once a strip had been exposed the sample was placed in the tensometer and peeled at a speed of 100 mm min⁻¹ for 12 seconds, resulting in a peel of 20 mm. An example set up is shown below (Figure 1, Pg. 4).

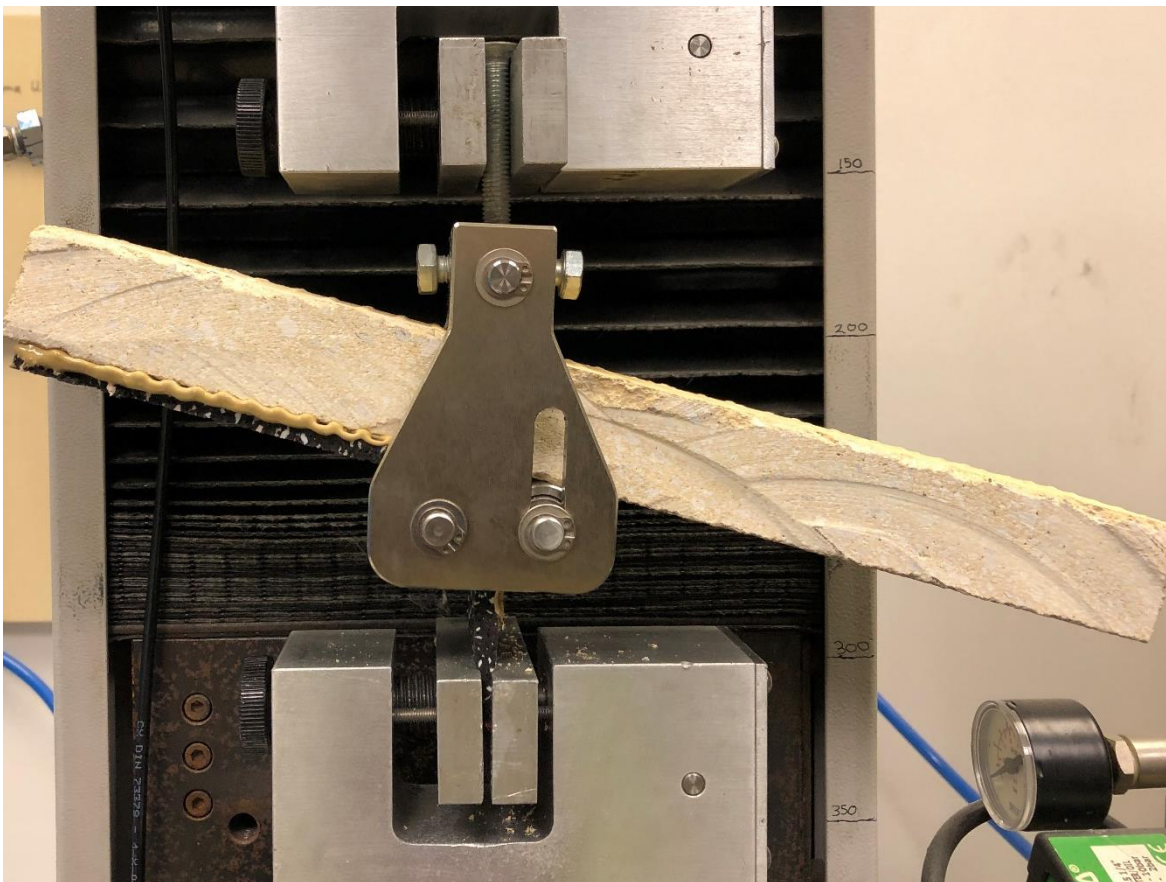


Figure 1 - Example of peel test being carried out on a sample on the tensometer and the floating roller

A large proportion of the samples failed prior to being placed in the tensometer resulting in it being impossible to record quantitative data for these samples. The results for all the initial testing is summarised in the table below (Table 2, Pg. 5-7). In all cases Substrate 1 is the substrate chosen to be peeled through the rollers.

The floating roller was not used for the sample of Everoll bonded to concrete, this is due to the thickness of the Everoll being too large for the gap in the rollers. Instead the concrete was secured to the moving jaws of the tensometer and the Everoll was peeled 90° from the surface.

Substrate 1	Substrate 2	REGUPOL 46-101 Initial Peel Test / N	REGUPOL 43-105 Initial Peel Test / N
REGUPOL 4515 Multi	Forbo Carpet Tiles	Substrate 1 Fail	69.2
REGUPOL 4515 Multi	Miliken	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Nora Ultra Grip TX	Substrate 1 Fail	67.2
REGUPOL 4515 Multi	Marmoleum	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	P5 Chipboard	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Parquet	Substrate 1 Fail	N/A
REGUPOL 4515 Multi	Engineered Timber	Substrate 1 Fail	54.4
REGUPOL 4515 Multi	Plywood	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Bamboo	Substrate 1 Fail	82.8
REGUPOL 4515 Multi	Gradus Carpet Tiles	Substrate 1 Fail	68.4
REGUPOL 4515 Multi	Paragon Carpet Tiles	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Amtico Carpet Tiles	Substrate 2 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Ceramic Tiles 6 mm	Substrate 1 Fail	N/A
REGUPOL 4515 Multi	Porcelain Tiles 8 mm thick	Substrate 1 Fail	N/A
REGUPOL 4515 Multi	Marble Tiles	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Forbo Carpet Tiles	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Miliken	Substrate 1 Fail	62.8
REGUPOL 4515 Eco	Marmoleum	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	P5 Chipboard	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Parquet	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Engineered Timber	Substrate 1 Fail	46.8 (Substrate 1 beginning to tear)
REGUPOL 4515 Eco	Plywood	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Bamboo	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Gradus Carpet Tiles	46.4	Substrate 1 Fail
REGUPOL 4515 Eco	Paragon Carpet Tiles	Substrate 1 Fail	Substrate 1 Fail

REGUPOL 4515 Eco	Amtico Carpet Tiles	46.4, Substrate 2 Fail	Substrate 1 Fail, Substrate 2 Damage
REGUPOL 4515 Eco	Ceramic Tiles 6 mm	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Porcelain Tiles 8 mm thick	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Marble Tiles	Substrate 1 Fail	N/A
REGUPOL 3912	Engineered Timber	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 3912	CPB	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Concrete	Substrate 1 Fail	50.4
REGUPOL 4515 Eco	Concrete	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 3912	Concrete	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 7210 C 3 mm	Forbo Carpet Tiles	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 7210 C 3 mm	Amtico Carpet Tiles	Substrate 2 Fail	Both Substrate Fail
REGUPOL 7210 C 3 mm	Parquet	Substrate 1 Fail	N/A
REGUPOL 7210 C 3 mm	Engineered Timber	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 7210 C 3 mm	18 mm Chipboard	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	STS Cementitious Board	Substrate 1 Fail	90.8
REGUPOL 4515 Eco	STS Cementitious Board	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 7210C	STS Cementitious Board	46.4	78.4
REGUPOL SH/Vibration 480	STS Cementitious Board	100.8	192.4
REGUPOL HT/Vibration 550	STS Cementitious Board	Substrate 1 Fail	338.4
REGUPOL XHT/Vibration 800	STS Cementitious Board	Substrate 1 Fail	67.2
REGUPOL MF/Vibration 1000	STS Cementitious Board	104.8	404.4
Soundlay Foam	STS Cementitious Board	Substrate 1 Fail	N/A
Soundlay Foam	STS Cementitious Board	N/A	Substrate 1 Fail
Soundlay Foam	Chipboard	N/A	Substrate 1 Fail
REGUPOL SH/Vibration 480	REGUPOL SH/Vibration 480	N/A	132.4
REGUPOL SH/Vibration 480	40/80	N/A	Substrate 2 Fail

REGUPOL SH/Vibration 480	High Impact Mat	N/A	115.8
REGUPOL SH/Vibration 480	Concrete	N/A	151.2
REGUPOL Impact Mat	STS Cementitious Board	N/A	108
REGUPOL Impact Mat	Everoll	N/A	240.8
Regufoam	High Impact Mat	N/A	168.8
Regufoam	STS Cementitious Board	N/A	72.4
REGUPOL 4515 Multi	Tarkett	Substrate 2 Fail	N/A
REGUPOL 4515 Multi	Quickstep Lyvin	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Tarkett LVT (1)	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Karndean	Substrate 1 Fail	79.2
REGUPOL 4515 Multi	Unilin Pergo Laminate	Substrate 1 Fail	100.4
REGUPOL 7210C	Ceramic Tile	60.0	64.8
Everoll	Concrete	58.4	N/A
REGUPOL 4515 Multi	Amtico LVT	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Amtico LVT	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Karndean LVT (2)	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Karndean LVT	Substrate 1 Fail	Substrate 1 Fail

Table 2 - Table summarising results from initial peel testing

Note: Due to the specifications of the floating roller BS EN ISO 22631:2019 there is a 6 ± 0.5 mm gap between the two rollers. Therefore, any substrate with a thickness greater than this will be squeezed through the gap and as a result the peel test is not representative of just the bond line. The applicable samples are written in red in the table above. The following substrates are thicker than the gap between the rollers:

- REGUPOL SH/Vibration 480
- REGUPOL HT/Vibration 550
- REGUPOL XHT/Vibration 800
- REGUPOL MF/Vibration 1000
- REGUPOL Impact Mat
- Regufoam
- Everoll

REGUPOL 46-101

As the results show, for the REGUPOL 46-101 adhesive, it was only possible to record peel test values for three samples without observable substrate failure, these being the samples of REGUPOL 4515 Eco bonded to Gradus Carpet Tile, 7210C on ceramic tile and 7210C on cementitious board. However, there are black specks in the adhesive of the latter suggesting that the REGUPOL crumb has been damaged by the peel. An image of this sample after peel testing is shown below (Figure 2, Pg. 9). Peel test data was recorded for REGUPOL 46-101 adhesive on both REGUPOL 4515 Multi and Eco bonded to Amtico Carpet Tile, however, after these samples were removed from the tensometer delamination of the Amtico Carpet Tile was observed (Figure 2, Pg. 9). Complete substrate failure was not observed for the Everoll on concrete; however, black crumbs were present in the adhesive, suggesting that there was some damage to the Everoll crumb. For all the remaining samples failure of the REGUPOL substrate was observed, an example of which is shown below (Figure 2, Pg. 9).



Figure 2 - Images of samples bonded using REGUPOL 46-101 adhesive after initial peel testing.

- Top Left: REGUPOL 4515 Eco on Gradus Carpet Tile, successful peel test.
- Top Right: REGUPOL 4515 Multi on Amtico Carpet Tile, delamination of carpet tile.
- Middle Left: REGUPOL 4515 Eco on Amtico Carpet Tile, delamination of carpet tile.
- Middle Right: REGUPOL 4515 Multi on Nora Ultra Grip TX, REGUPOL
- Bottom Left: REGUPOL 7210C on STS Cementitious Board. No complete substrate failure, but damage to REGUPOL crumb.
- Bottom Right: REGUPOL 4515 Multi on Tarkett. Transfer of text onto surface of REGUPOL 46-101 adhesive shows full delamination of surface of Tarkett

REGUPOL 43-105

As the table shows, it was possible to obtain more quantitative results for peel testing for the REGUPOL 43-105 adhesive when compared to the REGUPOL 46-101 adhesive with fewer tests resulting in substrate failure. Conversely, for the sample of REGUPOL 4515 Eco bonded to Gradus Carpet tile substrate failure was observed with the REGUPOL 43-105 adhesive, whereas this was not the case for the REGUPOL 46-101 adhesive (Figure 3, Pg. 11). Peel data was recorded for the sample of REGUPOL 4515 Eco bonded to Engineered Timber, however, the REGUPOL sample began to tear at the end of the test suggesting that substrate failure was imminent (Figure 3, Pg. 11). The sample of REGUPOL 4515 Eco bonded to Amtico Carpet tile resulted in failure of both substrates, with the bottom layer of the carpet tile delaminating during the testing. An example of a sample with a successfully completed peel test is shown below (Figure 3, Pg. 11).



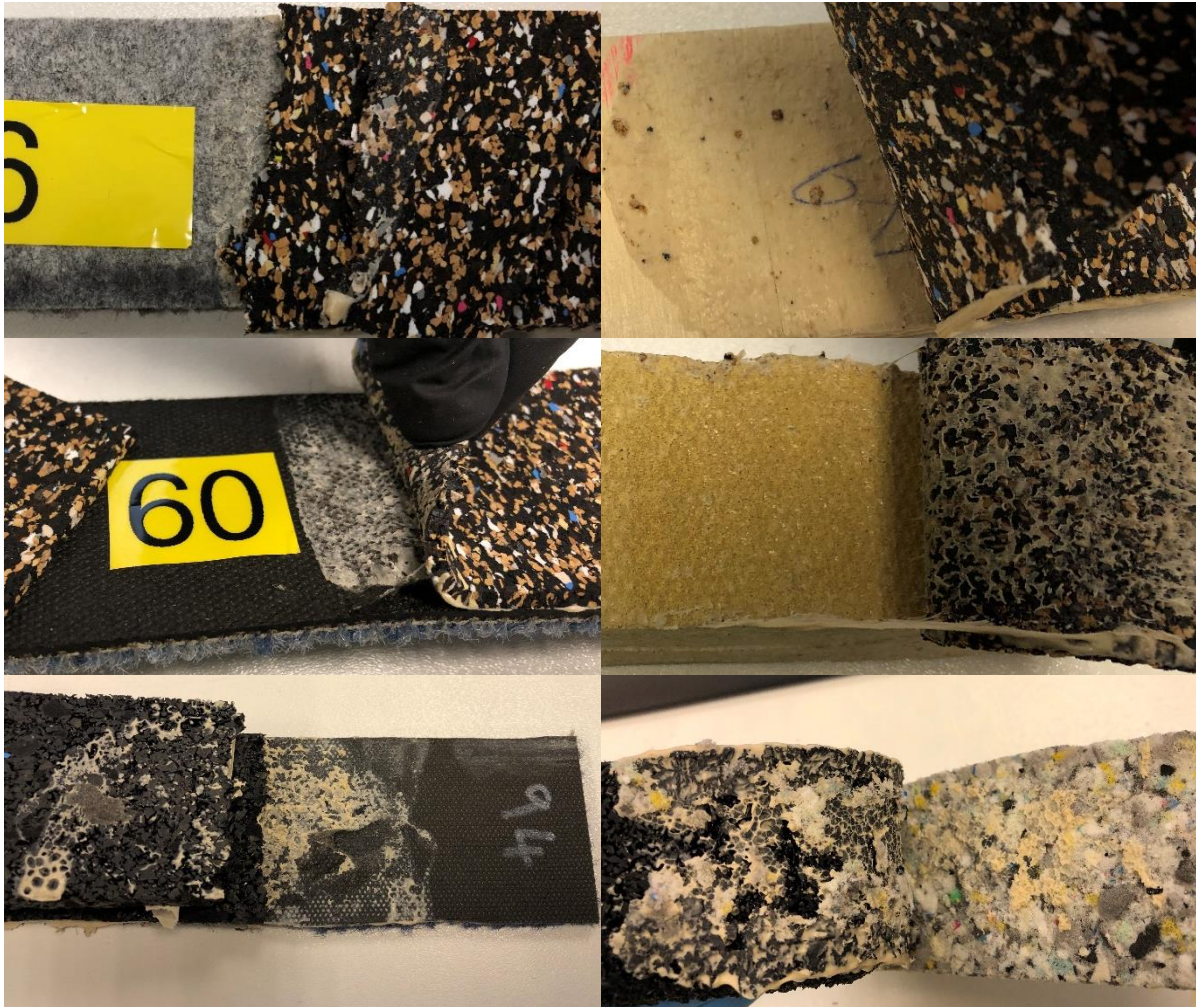


Figure 3 - Images of samples bonded using REGUPOL 43-105 adhesive after initial peel testing.

- Top Left: REGUPOL 4515 Eco on Gradus Carpet Tile, substrate failure
- Top Right: REGUPOL 4515 Eco on Engineered Timber, REGUPOL beginning to tear at the end of test
- Middle Left: REGUPOL 4515 Eco on Amtico Carpet Tile, failure of both substrates
- Middle Right: REGUPOL 4515 Multi on Concrete, successful peel test
- Bottom Left: REGUPOL 7210C on Amtico Carpet Tile. Substrate failure of REGUPOL
- Bottom Right: REGUPOL Vibration 480 on 40/80. Substrate failure of foam crumb

As stated above, some substrates were thicker than the gap in the rollers, therefore the absolute value of the peel strength may not be applicable to the bond strength. However, in samples with substrate failure, this failure occurred at the bond line. An example of which is REGUPOL Vibration 480 on 40/80 (Bottom Right in images above). This sample resulted in substrate failure, with the foam crumb being destroyed during the peeling process.

Climate Testing

Further testing specified by BS EN ISO 22631:2019 requires climate testing of the samples. The testing is as follows:

- 7 days at a standard atmosphere of 23 °C, 50 % relative humidity
- 20 days at 50 ± 2 °C
- 1 day at a standard atmosphere of 23 °C, 50 % relative humidity

The following samples were placed in a climate chamber to carry out climate testing (Table 3, Pg. 12-13).

Substrate 1	Substrate 2	REGUPOL 46-101	REGUPOL 43-105
REGUPOL 4515 Multi	Nora Ultra Grip TX	Bonded	Bonded
REGUPOL 4515 Multi	Marmoleum	Bonded	Bonded
REGUPOL 4515 Multi	P5 Chipboard	Bonded	Bonded
REGUPOL 4515 Multi	Parquet	Bonded	N/A
REGUPOL 4515 Multi	Engineered Timber	Bonded	Bonded
REGUPOL 4515 Multi	Plywood	Bonded	Bonded
REGUPOL 4515 Multi	Bamboo	Bonded	Bonded
REGUPOL 4515 Multi	Ceramic Tiles 8mm-14mm	Bonded	N/A
REGUPOL 4515 Multi	Porcelain Tiles min 8 mm thick	Bonded	N/A
REGUPOL 4515 Multi	Marble Tiles	Bonded	N/A
REGUPOL 4515 Eco	Marmoleum	Bonded	Bonded
REGUPOL 4515 Eco	P5 Chipboard	Bonded	Bonded
REGUPOL 4515 Eco	Parquet	Bonded	N/A
REGUPOL 4515 Eco	Engineered Timber	Bonded	Bonded
REGUPOL 4515 Eco	Plywood	Bonded	Bonded
REGUPOL 4515 Eco	Bamboo	Bonded	Bonded
REGUPOL 4515 Eco	Ceramic Tiles 8mm-14mm	Bonded	N/A
REGUPOL 4515 Eco	Porcelain Tiles min 8 mm thick	Bonded	N/A
REGUPOL 4515 Eco	Marble Tiles	Bonded	N/A
REGUPOL 3912	Engineered Timber	Bonded	Bonded
REGUPOL 3912	CPB	Bonded	Bonded
REGUPOL 4515 Multi	Concrete	Bonded	Bonded
REGUPOL 4515 Eco	Concrete	Bonded	Bonded
REGUPOL 3912	Concrete	Bonded	Bonded
REGUPOL 7210 C 3 mm	Forbo Carpet Tiles	Bonded	Bonded
REGUPOL 7210 C 3 mm	Amtico Carpet Tiles	Bonded	Bonded
REGUPOL 7210 C 3 mm	Parquet	Bonded	N/A
REGUPOL 7210 C 3 mm	Engineered Timber	Bonded	Bonded

REGUPOL 7210 C 3 mm	18 mm Chipboard	Bonded	Bonded
REGUPOL 4515 Multi	STS Cementitious Board	Bonded	Bonded
REGUPOL 4515 Eco	STS Cementitious Board	Bonded	Bonded
REGUPOL 7210C	STS Cementitious Board	Bonded	Bonded
REGUPOL SH/Vibration 480	STS Cementitious Board	Bonded	Bonded
REGUPOL HT/Vibration 550	STS Cementitious Board	Bonded	Bonded
REGUPOL XHT/Vibration 800	STS Cementitious Board	Bonded	Bonded
REGUPOL MF/Vibration 1000	STS Cementitious Board	Bonded	Bonded
Soundlay Foam	STS Cementitious Board	Bonded	N/A
Soundlay Foam	STS Cementitious Board	N/A	Bonded
Soundlay Foam	Chipboard	N/A	Bonded
REGUPOL SH/Vibration 480	REGUPOL SH/Vibration 480	N/A	Bonded
REGUPOL SH/Vibration 480	40/80	N/A	Bonded
REGUPOL SH/Vibration 480	High Impact Mat	N/A	Bonded
REGUPOL SH/Vibration 480	Concrete	N/A	Bonded
REGUPOL Impact Mat	STS Cementitious Board	N/A	Bonded
REGUPOL Impact Mat	Everoll	N/A	Bonded
Regufoam	High Impact Mat	N/A	Bonded
Regufoam	STS Cementitious Board	N/A	Bonded
REGUPOL 4515 Multi	Quickstep Lyvin	Bonded	Bonded
REGUPOL 4515 Multi	Tarkett LVT	Bonded	Bonded
REGUPOL 4515 Multi	Karndean LVT (1)	Bonded	Bonded
REGUPOL 4515 Multi	Unilin Pergo Laminate	Bonded	Bonded
REGUPOL 7210C	Ceramic Tile	Bonded	Bonded
Everoll	Concrete	Bonded	N/A
REGUPOL 4515 Multi	Amtico LVT	Bonded	Bonded
REGUPOL 4515 Eco	Amtico LVT	Bonded	Bonded
REGUPOL 4515 Muti	Karndean LVT (2)*	Bonded	Bonded
REGUPOL 4515 Eco	Karndean LVT	Bonded	Bonded

Table 3 - Table showing the samples put through climate testing

* Karndean LVT test was repeated with REGUPOL 4515 Multi. The tests were carried out following identical procedures, numbers used to differentiate the two tests.

Peel testing was carried out following the procedure outlined above (Climate and Peel Testing, Pg. 4). To ensure that there was ~50 mm unbonded section of Substrate 1 available, the adhesive was carefully cut through the bond using a sharp blade. The results of the peel testing are detailed in the table below (Table 4, Pg. 14-16).

Substrate 1	Substrate 2	REGUPOL 46-101 Climate Test Peel / N	REGUPOL 43-105 Climate Test Peel / N
REGUPOL 4515 Multi	Nora Ultra Grip TX	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Marmoleum	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	P5 Chipboard	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Parquet	Substrate 1 Fail	N/A
REGUPOL 4515 Multi	Engineered Timber	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Plywood	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Bamboo	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Ceramic Tiles 8mm-14mm	Substrate 1 Fail	N/A
REGUPOL 4515 Multi	Porcelain Tiles min 8 mm thick	Substrate 1 Fail	N/A
REGUPOL 4515 Multi	Marble Tiles	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Marmoleum	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	P5 Chipboard	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Parquet	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Engineered Timber	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Plywood	Substrate 1 Fail	56
REGUPOL 4515 Eco	Bamboo	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Ceramic Tiles 8mm-14mm	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Porcelain Tiles min 8 mm thick	Substrate 1 Fail	N/A
REGUPOL 4515 Eco	Marble Tiles	Substrate 1 Fail	N/A
REGUPOL 3912	Engineered Timber	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 3912	CPB	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Concrete	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Concrete	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 3912	Concrete	Substrate 1 Fail	Substrate 1 Fail

REGUPOL 7210 C 3 mm	Forbo Carpet Tiles	Both Substrate Fail	Substrate 1 Fail
REGUPOL 7210 C 3 mm	Amtico Carpet Tiles	Substrate 2 Fail	Substrate 2 Fail
REGUPOL 7210 C 3 mm	Parquet	N/A	Substrate 1 Fail
REGUPOL 7210 C 3 mm	Engineered Timber	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 7210 C 3 mm	18 mm Chipboard	Substrate 1 Fail	91.2
REGUPOL 4515 Multi	STS Cementitious Board	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	STS Cementitious Board	Substrate 2 Damage	Substrate 1 Fail
REGUPOL 7210C	STS Cementitious Board	Substrate 2 Damage	Substrate 1 Fail
REGUPOL SH/Vibration 480	STS Cementitious Board	108.0	132.4
REGUPOL HT/Vibration 550	STS Cementitious Board	Substrate 1 Fail	Substrate 1 Fail
REGUPOL XHT/Vibration 800	STS Cementitious Board	125.6	Substrate 1 Fail
REGUPOL MF/Vibration 1000	STS Cementitious Board	224	135.6
Soundlay Foam	STS Cementitious Board	N/A	Substrate 1 Fail
Soundlay Foam	STS Cementitious Board	Substrate 1 Fail	N/A
Soundlay Foam	Chipboard	Substrate 1 Fail	N/A
REGUPOL SH/Vibration 480	REGUPOL SH/Vibration 480	Substrate 1 Fail	N/A
REGUPOL SH/Vibration 480	40/80	Substrate 1 Fail	N/A
REGUPOL SH/Vibration 480	High Impact Mat	62.0	N/A
REGUPOL SH/Vibration 480	Concrete	Substrate 1 Fail	N/A
REGUPOL Impact Mat	STS Cementitious Board	236.4	N/A
REGUPOL Impact Mat	Everoll	342.8	N/A
Regufoam	High Impact Mat	Substrate 1 Fail	N/A
Regufoam	STS Cementitious Board	190.8	N/A
REGUPOL 4515 Multi	Quickstep Lyvin	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Tarkett LVT	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Karndean LVT (1)	Substrate 1 Fail	Substrate 1 Fail

REGUPOL 4515 Multi	Unilin Pergo Laminate	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 7210C	Ceramic Tile	Substrate 1 Fail	76.8
Everoll	Concrete	86.8	N/A
REGUPOL 4515 Multi	Amtico LVT	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Amtico LVT	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Multi	Karndean LVT (2)	Substrate 1 Fail	Substrate 1 Fail
REGUPOL 4515 Eco	Karndean LVT	Substrate 1 Fail	Substrate 1 Fail

Table 4 - Table summarising the results from the peel testing after the climate test

Note: As stated above, due to the specifications of the floating roller BS EN ISO 22631:2019 there is a 6 ± 0.5 mm gap between the two rollers. Therefore, any substrate with a thickness greater than this will be squeezed through the gap and as a result the peel test is not representative of just the bond line. The applicable samples are written in red in the table above. The following substrates are thicker than the gap between the rollers:

- REGUPOL SH/Vibration 480
- REGUPOL HT/Vibration 550
- REGUPOL XHT/Vibration 800
- REGUPOL MF/Vibration 1000
- REGUPOL Impact Mat
- Regufoam
- Everoll

REGUPOL 46-101

As you can see from the results, every sample with a thickness lower than the gap in the rollers bonded with REGUPOL 46-101 adhesive resulted in substrate failure. This shows that during the climate testing the bond strength did not degrade. The sample of Everoll to concrete did not result in complete substrate failure, however, the peel strength increased compared to the initial test, and there are signs of crumb damage to the Everoll. Images are shown below of a selection of samples after peel testing (Figure 4, Pg. 17).

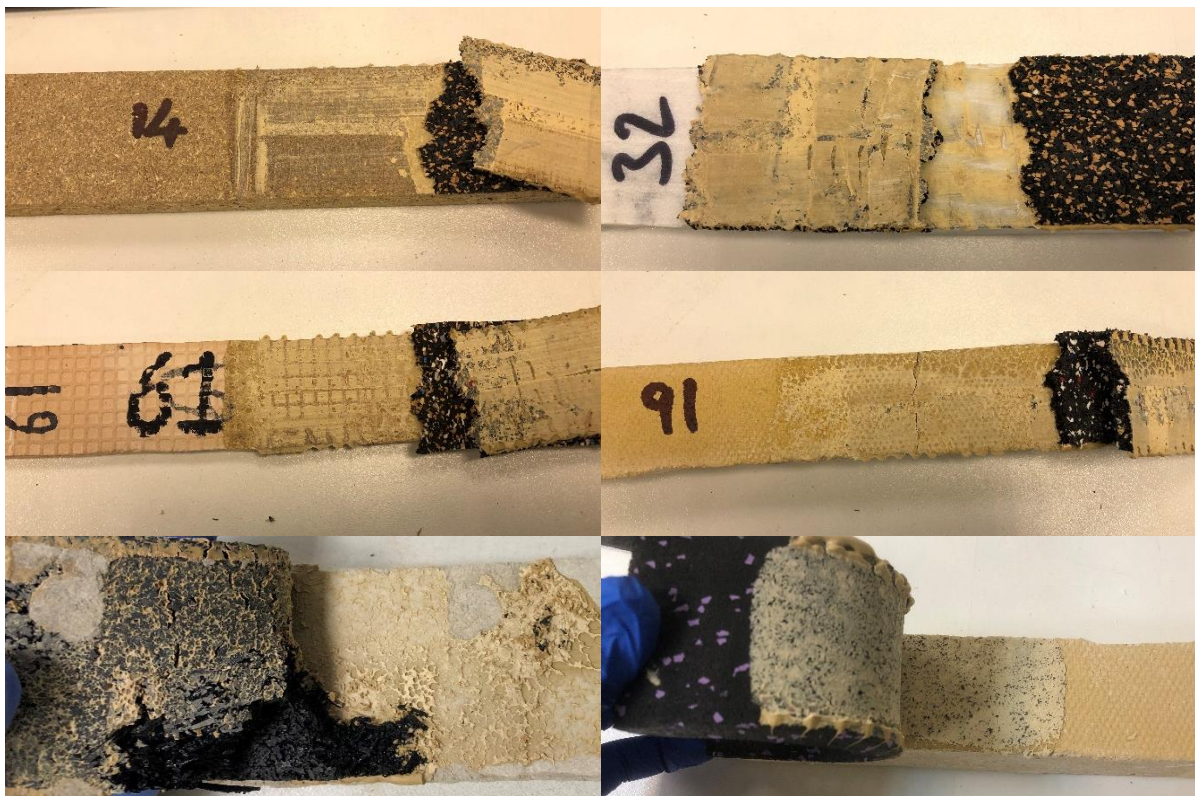


Figure 4 - Images of samples bonded using REGUPOL 46-101 adhesive after peel testing following climate testing

- Top Left: REGUPOL 4515 Multi on Chipboard, REGUPOL fail
- Top Right: REGUPOL 4515 Multi on Marble Tile, REGUPOL fail
- Middle Left: REGUPOL 4515 Eco on Ceramic Tile, REGUPOL fail
- Middle Right: REGUPOL 3912 on Concrete, REGUPOL fail
- Bottom Left: REGUPOL XHT/Vibration 800 on Concrete. REGUPOL fail
- Bottom Right: Everoll on Concrete, crumb damage to Everoll

As stated above, some substrates were thicker than the gap in the rollers, therefore the absolute value of the peel strength may not be applicable to the bond strength. However, in samples with substrate failure, this failure occurred at the bond line. An example of which is REGUPOL Vibration 800 on Concrete (Bottom Left in images above). This sample resulted in substrate failure, with the REGUPOL sample tearing.

REGUPOL 43-105

As you can see from the results, only three samples with a thickness lower than the gap in the rollers had successful peel tests, these being REGUPOL 4515 Eco on Plywood, REGUPOL 7510C on 18 mm chipboard and REGUPOL 7210C on ceramic tile. Every other sample resulted in failure of the REGUPOL substrate. This includes some samples in which successful peel tests were carried out during the initial testing. These samples were:

- REGUPOL 4515 Multi on Nora Ultra Grip TX
- REGUPOL 4515 Multi on Engineered Timber
- REGUPOL 4515 Multi on Bamboo
- REGUPOL 4515 Multi on Concrete

The reasons for the substrate failure after climate testing are likely a result of the elevated temperature further curing the adhesive. The results show that there was no degradation of adhesive performance during the climate testing. Example images of samples are shown below (Figure 5, Pg. 19).

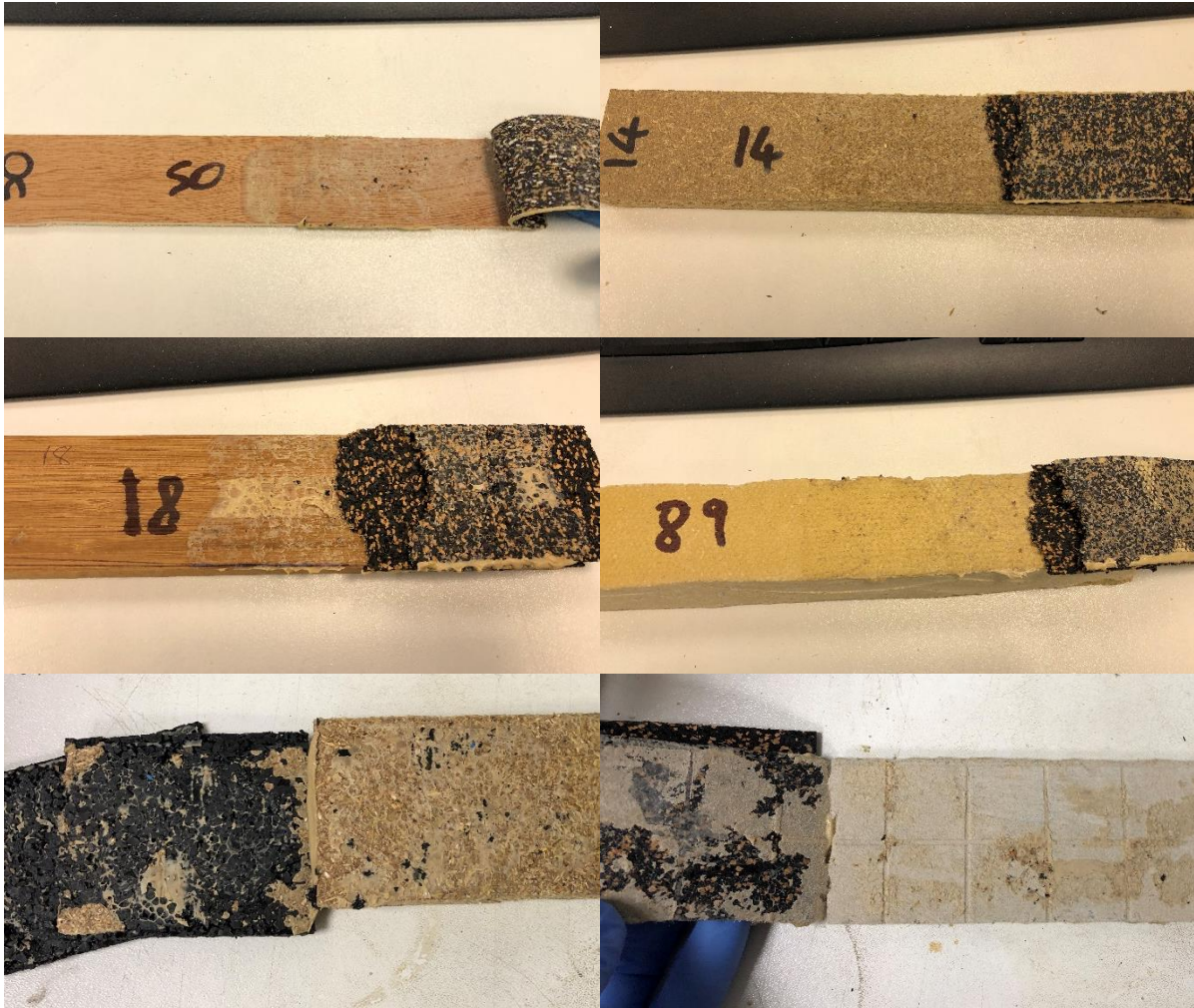


Figure 5 - Images of samples bonded using REGUPOL 43-105 adhesive after peel testing following climate testing

- Top Left: REGUPOL 4515 Eco on Plywood, successful peel test
- Top Right: REGUPOL 4515 Multi on Chipboard, REGUPOL fail
- Middle Left: REGUPOL 4515 Multi on Bamboo, REGUPOL fail
- Middle Right: REGUPOL 4515 Multi on Concrete, REGUPOL fail. This sample had a successful peel test during initial testing
- Bottom Left: REGUPOL 7210C on 18 mm Chipboard. Adhesion break with some signs of crumb damage
- Bottom Right: REGUPOL 4515 Eco on STS Cementitious Board. Damage to top surface of concrete substrate

As stated above, some substrates were thicker than the gap in the rollers, therefore the absolute value of the peel strength may not be applicable to the bond strength. However, in samples with substrate failure, this failure occurred at the bond line.

Conclusion

The results show that both the REGUPOL 43-105 and REGUPOL 46-101 adhesives are well suited to bond the chosen substrates, with most samples resulting in failure of the substrates rather than the adhesive involved. This is confirmed during the peel testing after climate testing with most samples resulting in substrate failure. There are challenges with testing some of the samples to BS EN ISO 22631:2019, due to the requirement of the fixed roller distance, samples with a substrate thicker than this distance are squeezed through the opening during peel testing. There is no way to determine whether the values for peel testing are a result of the squeezing of the substrate or the act of peeling back the substrate. However, any substrate failure observed during the testing of these samples occurred at the bond line, showing that this is a result of the adhesive.