coatings

# Supplementary Materials: Moisture Sorption of Wood Surfaces Modified by One-Sided Carbonization as An Alternative to Traditional Façade Coatings

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**Table S1.** Welch's ANOVA for equality of means on permeability, moisture exclusion efficiency (MEE), liquid water sorption and cupping after water vapor sorption, within species between modifications. Post hoc results illustrated in Tables S3-S6.

| Experimental setup | Species | Statistic* | df1 | df2 | *Sig.*** |
|---|---|---|---|---|---|
| Permeability | Aspen | 36.74 | 6 | 1.,53 | *<0.001* |
| | Birch | 196.36 | 6 | 27.72 | *<0.001* |
| | Pine | 19.15 | 6 | 14.81 | *<0.001* |
| | Spruce | 26.19 | 6 | 20.79 | *<0.001* |
| MEE | Aspen | 71.31 | 5 | 13.50 | *<0.001* |
| | Birch | 39.14. | 5 | 13.66 | *<0.001* |
| | Pine | 29.05 | 5 | 13.31 | *<0.001* |
| | Spruce | 17.97 | 5 | 13.31 | *<0.001* |
| Liquid water uptake | Aspen | 8.37 | 5 | 8.57 | *0.004* |
| | Birch | 21.612 | 5 | 12.78 | *<0.001* |
| | Pine | 55.78 | 5 | 11.78 | *<0.001* |
| | Spruce | 14.53 | 5 | 13.03 | *<0.001* |
| Cupping | Aspen | 116.77 | 6 | 16.35 | *<0.001* |
| | Birch | 113.94 | 6 | 13.75 | *<0.001* |
| | Pine | 32.92 | 6 | 15.45 | *<0.001* |
| | Spruce | 26.57 | 6 | 15.51 | *<0.001* |

* *Asymptotically F distributed*
** $\alpha = 0.05$

**Table S2.** Welch's ANOVA for equality of means on permeability, moisture exclusion efficiency (MEE), liquid water sorption and cupping after water vapor sorption, within modifications, between species. Post hoc results illustrated in Tables S7-S10.

| Experimental setup | Modification | Statistic* | df1 | df2 | *Sig.*** |
|---|---|---|---|---|---|
| Permeability | R | 431.31 | 3 | 12.41 | *<0.001* |
| | R-O | 207.64 | 3 | 12.02 | *<0.001* |
| | P | 1233.95 | 3 | 15.32 | *<0.001* |
| | CC | 53.91 | 3 | 17.91 | *<0.001* |
| | CC-O | 55.00 | 3 | 14.26 | *<0.001* |
| | F | 322.74 | 3 | 10.76 | *<0.001* |
| | F-O | 121.64 | 3 | 9.94 | *<0.001* |
| MEE*** | R | - | - | - | - |
| | R-O | 0.11 | 3 | 8.87 | *0.953* |
| | P | 10.60 | 3 | 10.64 | *0.002* |
| | CC | 19.53 | 3 | 11.20 | *<0.001* |
| | CC-O | 9.74 | 3 | 10.69 | *0.002* |
| | F | 12.93 | 3 | 9.92 | *<0.001* |
| | F-O | 0.68 | 3 | 9.55 | *0.586* |
| Liquid water uptake | R | 1.60 | 3 | 10.63 | *0.247* |
| | R-O | 8.05 | 3 | 6.09 | *0.015* |
| | P | 5.30 | 3 | 6.58 | *0.095* |
| | CC | 2.76 | 3 | 9.95 | *0.098* |
| | CC-O | - | - | - | - |
| | F | 30.71 | 3 | 8.98 | *<0.001* |
| | F-O | 14.19 | 3 | 9.93 | *<0.001* |
| Cupping | R | 47.28 | 3 | 10.76 | *<0.001* |
| | R-O | 50.05 | 3 | 8.71 | *<0.001* |
| | P | 31.35 | 3 | 10.28 | *<0.001* |
| | CC | 17.68 | 3 | 10.65 | *<0.001* |
| | CC-O | 24.31 | 3 | 11.05 | *<0.001* |
| | F | 1.64 | 3 | 10.63 | *0.240* |
| | F-O | 0.95 | 3 | 9.99 | *0.454* |

* *Asymptotically F distributed*
** $\alpha = 0.05$
*** *in comparison to unmodified reference*

**Table S3.** Water vapor permeability at 95%RH. Within species comparison of modification effect, compared modifications marked with blue color differ significantly by Tamhane's T2 at 5% significance.

| Comparison | Aspen | Birch | Pine | Spruce |
|---|---|---|---|---|
| R-RO | | | | |
| R-P | | | | |
| R-CC | | | | |
| R-CCO | | | | |
| R-F | | | | |
| R-FO | | | | |
| RO-P | | | | |
| RO-CC | | | | |
| RO-CCO | | | | |
| RO-F | | | | |
| RO-FO | | | | |
| P-CC | | | | |
| P-CCO | | | | |
| P-F | | | | |
| P-FO | | | | |
| CC-CCO | | | | |
| CC-F | | | | |
| CC-FO | | | | |
| CCO-F | | | | |
| CCO-FO | | | | |
| F-FO | | | | |

**Table S4.** MEE (%) Within species comparison of modification effect, compared modifications marked with yellow color differ significantly by Tamhane's T2 at 5% significance.

| Comparison | Aspen | Birch | Pine | Spruce |
|---|---|---|---|---|
| RO-P | | | | |
| RO-CC | | | | |
| RO-CCO | | | | |
| RO-F | | | | |
| RO-FO | | | | |
| P-CC | | | | |
| P-CCO | | | | |
| P-F | | | | |
| P-FO | | | | |
| CC-CCO | | | | |
| CC-F | | | | |
| CC-FO | | | | |
| CCO-F | | | | |
| CCO-FO | | | | |
| F-FO | | | | |

**Table S5.** Liquid water uptake at 96 h. Within species comparison of modification effect, compared modifications marked with green color differ significantly by Tamhane's T2 at 5% significance.

| Comparison | Aspen | Birch | Pine | Spruce |
|---|---|---|---|---|
| R-RO | | | | |
| R-P | | | | |
| R-CC | | | | |
| R-F | | | | |
| R-FO | | | | |
| RO-P | | | | |
| RO-CC | | | | |
| RO-F | | | | |
| RO-FO | | | | |
| P-CC | | | | |
| P-F | | | | |
| P-FO | | | | |
| CC-F | | | | |
| CC-FO | | | | |
| F-FO | | | | |

**Table S6.** Cupping at 30% and 95% RH. Within species comparison of modification effect, compared modifications marked with orange color differ significantly by Tamhane's T2 at 5% significance. Darker orange stands for significant differences at 95% RH, whereas lighter orange for differences seen at 30% RH.

| Comparison | Aspen | | Birch | | Pine | | Spruce | |
|---|---|---|---|---|---|---|---|---|
| | 30%RH | 95%RH | 30%RH | 95%RH | 30%RH | 95%RH | 30%RH | 95%RH |
| R-RO | | | | | | | | |
| R-P | | | | | | | | |
| R-CC | | | | | | | | |
| R-CCO | | | | | | | | |
| R-F | | | | | | | | |
| R-FO | | | | | | | | |
| RO-P | | | | | | | | |
| RO-CC | | | | | | | | |
| RO-CCO | | | | | | | | |
| RO-F | | | | | | | | |
| RO-FO | | | | | | | | |
| P-CC | | | | | | | | |
| P-CCO | | | | | | | | |
| P-F | | | | | | | | |
| P-FO | | | | | | | | |
| CC-CCO | | | | | | | | |
| CC-F | | | | | | | | |
| CC-FO | | | | | | | | |
| CCO-F | | | | | | | | |
| CCO-FO | | | | | | | | |
| F-FO | | | | | | | | |

**Table S7.** Water vapor permeability at 95% RH. Comparison between species within same modification, variables marked with blue color differ significantly by Tamhane's T2 at 5% significance.

| Modification | AR | BR | PR | SR | ARO | BRO | PRO | SRO | AP | BP | PP | SP | ACC | BCC | PCC | SCC | ACCO | BCCO | PCCO | SCCO | AF | BF | PF | SF | AFO | BFO | PFO | SFO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AR | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BR | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PR | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ARO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BRO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SRO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AP | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BP | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PP | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SP | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ACC | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BCC | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PCC | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SCC | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ACCO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BCCO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PCCO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SCCO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AF | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BF | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PF | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SF | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AFO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BFO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SFO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Table S8.** MEE (%) Comparison between species within same modification, variables marked with yellow color differ significantly by Tamhane's T2 at 5% significance. Note: only significantly different (at $p < 0.05$) groups revealed by comparison of means have been subjected to post hoc analysis.

| Modification | AP | BP | PP | SP | ACC | BCC | PCC | SCC | ACCO | BCCO | PCCO | SCCO | AF | BF | PF | SF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AP | | | | | | | | | | | | | | | | |
| BP | | | | | | | | | | | | | | | | |
| PP | | | | | | | | | | | | | | | | |
| SP | | | | | | | | | | | | | | | | |
| ACC | | | | | | | | | | | | | | | | |
| BCC | | | | | | | | | | | | | | | | |
| PCC | | | | | | | | | | | | | | | | |
| SCC | | | | | | | | | | | | | | | | |
| ACCO | | | | | | | | | | | | | | | | |
| BCCO | | | | | | | | | | | | | | | | |
| PCCO | | | | | | | | | | | | | | | | |
| SCCO | | | | | | | | | | | | | | | | |
| AF | | | | | | | | | | | | | | | | |
| BF | | | | | | | | | | | | | | | | |
| PF | | | | | | | | | | | | | | | | |
| SF | | | | | | | | | | | | | | | | |

**Table S9.** Liquid water uptake at 96 h. variables marked with yellow color differ significantly by Tamhane's T2 at 5% significance. Note: only significantly different (at $p < 0.05$) groups revealed by comparison of means have been subjected to post hoc analysis.

| Modification | ARO | BRO | PRO | SRO | AF | BF | PF | SF | AFO | BFO | PFO | SFO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARO | | | | | | | | | | | | |
| BRO | | | | | | | | | | | | |
| PRO | | | | | | | | | | | | |
| SRO | | | | | | | | | | | | |
| AF | | | | | | | | | | | | |
| BF | | | | | | | | | | | | |
| PF | | | | | | | | | | | | |
| SF | | | | | | | | | | | | |
| AFO | | | | | | | | | | | | |
| BFO | | | | | | | | | | | | |
| PFO | | | | | | | | | | | | |
| SFO | | | | | | | | | | | | |

**Table S10.** Cupping at 30% and 95% RH. Comparison between species within same modification, variables marked with orange color differ significantly by Tamhane's T2 at 5% significance. Note: only significantly different (at $p < 0.05$) groups revealed by comparison of means have been subjected to post hoc analysis. Darker orange stands for significant differences at 95% RH, whereas lighter orange for differences seen at 30% RH.

| Modification | AR | BR | PR | SR | ARO | BRO | PRO | SRO | AP | BP | PP | SP | ACC | BCC | PCC | SCC | ACCO | BCCO | PCCO | SCCO | AF | BF | PF | SF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AR | | | | | | | | | | | | | | | | | | | | | | | | |
| BR | | | | | | | | | | | | | | | | | | | | | | | | |
| PR | | | | | | | | | | | | | | | | | | | | | | | | |
| SR | | | | | | | | | | | | | | | | | | | | | | | | |
| ARO | | | | | | | | | | | | | | | | | | | | | | | | |
| BRO | | | | | | | | | | | | | | | | | | | | | | | | |
| PRO | | | | | | | | | | | | | | | | | | | | | | | | |
| SRO | | | | | | | | | | | | | | | | | | | | | | | | |
| AP | | | | | | | | | | | | | | | | | | | | | | | | |
| BP | | | | | | | | | | | | | | | | | | | | | | | | |
| PP | | | | | | | | | | | | | | | | | | | | | | | | |
| SP | | | | | | | | | | | | | | | | | | | | | | | | |
| ACC | | | | | | | | | | | | | | | | | | | | | | | | |
| BCC | | | | | | | | | | | | | | | | | | | | | | | | |
| PCC | | | | | | | | | | | | | | | | | | | | | | | | |
| SCC | | | | | | | | | | | | | | | | | | | | | | | | |
| ACCO | | | | | | | | | | | | | | | | | | | | | | | | |
| BCCO | | | | | | | | | | | | | | | | | | | | | | | | |
| PCCO | | | | | | | | | | | | | | | | | | | | | | | | |
| SCCO | | | | | | | | | | | | | | | | | | | | | | | | |
| AF | | | | | | | | | | | | | | | | | | | | | | | | |
| BF | | | | | | | | | | | | | | | | | | | | | | | | |
| PF | | | | | | | | | | | | | | | | | | | | | | | | |
| SF | | | | | | | | | | | | | | | | | | | | | | | | |

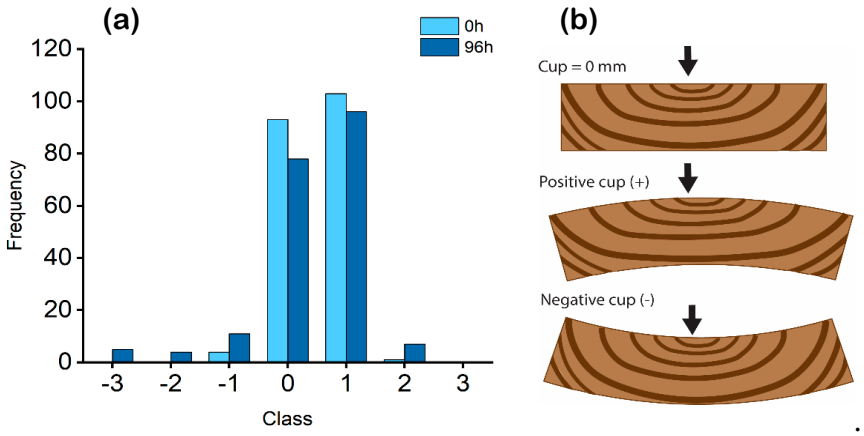


**Figure S1.** (**a**) Frequency of samples classified by magnitude of cup: -3 (equal or more than -3 mm); -2 (-2 to -3 mm); -1 (-1 to -2 mm); 0 (-0.99 to 0.99); 1 (1 to 2 mm); 2 (2 to 3 mm); 3 (equal or more than 3 mm) measured at 96 h into liquid water floating (from modified surface). (**b**) schematic illustration of cupping when measured from pith side/modified face of the sample. Positive = "bow", negative = "cup".