

WESTERN MICRO-ANALYTICAL LABORATORY



FBA and AF&PA
Test Protocol
Issued: November 11, 2007

Repulpability & Recyclability

Repulping and Recycling Corrugated Fiberboard
Treated to Improve Its Performance in the Presence of
Water and Water Vapor

Submitting Company: NANOZEO

Test Sample Name: NANOZEO TREATED

Control Sample Name: IP/IGI CONTROL

Test Dates: OCTOBER 12-14, 2009

Date Report Completed: 16-Oct-09

WESTERN MICHIGAN UNIVERSITY



REPORT RESULTS: REPULPABILITY PROCESS (PART 1)

Trial: NANOZEO

Date Run: 10/12/09

Sample: NANOZEO TREATED

	Set #1:	Set #2:	Set #3: (if required)
Is sample representative of the material as a whole?	<u>Y</u>	<u>Y</u>	<u> </u>
STARTING SAMPLE			
Moisture Content	<u>9 %</u>	<u>9 %</u>	<u> </u> %
Temperature Range	<u>119 °F</u>	<u>120 °F</u>	<u> </u> °F
Amount of Fiber in Charge	<u>25 g</u>	<u>25 g</u>	<u> </u> g
Temp & pH Maintained?	<u>Y</u>	<u>Y</u>	<u> </u>
Hot Slurry Charged To Flat Screen, as Instructed?	<u>Y</u>	<u>Y</u>	<u> </u>
FINISHED SAMPLE: Oven dry mass			
Amount of Fiber Rejects	<u>0.019 g</u>	<u>0.082 g</u>	<u> </u> g
Amount of Fiber Accepts	<u>16.09 g</u>	<u>16.96 g</u>	<u> </u> g
Yield of Sample (% Accepts)	<u>99.9 %</u>	<u>99.5 %</u>	<u>####</u> %
Observe and note deposition on vessel walls, screens, moving parts, etc.			
Disposition Observed? If yes, detail below.	<u>N</u>	<u>N</u>	<u> </u>

SUMMARY

Operational Impact:
Yield:

<u>Pass</u>	<u>Pass</u>	<u> </u>
<u>Pass</u>	<u>Pass</u>	<u> </u>

Note, details:

WESTERN MICHIGAN UNIVERSITY



REPORT RESULTS: RECYCLABILITY PROCESS (PART 2)

Trial: NANOZEO

Date Run: 10/13-14/09

Sample: C-1 T-1

	Untreated Control	Recyclability Test Sample
Is sample representative of the lot as a whole?	<u> Y </u>	<u> Y </u>
Moisture Content	<u> 7.60% </u>	<u> 9% </u>
Pulping		
At 3% Consistency?	<u> Y </u>	<u> Y </u>
20/80% Charged by weight?		<u> Y </u>
If greater than 20/80%, specify ratio here:		<u> </u> %
Temp & pH maintained, per App. B, #3?	<u> Y </u>	<u> Y </u>
Number of batches required?	<u> 1 </u>	<u> 1 </u>
0.0625 Screens		
1% (note if different) Consistency, Temp & pH, per App. B, #5?	<u> Y </u>	<u> Y </u>
10% Volumetric Reject Rate?	<u> Y </u>	<u> Y </u>
0.010 Basket:		
Temp, pH, & Reject Rate, per App B, #6?	<u> Y </u>	<u> Y </u>
Reverse Cleaners:		
Temp & Pressure Differential, per App B, #7?	<u> Y </u>	<u> Y </u>
Determine Volumetric Reject Rate	<u> 15.8 </u>	<u> 19.4 gpm </u>
Was it necessary to stop the test to clean any apparatus at any time during this procedure?	<u> N </u>	<u> N </u>
Disposition observed? If yes, note detail below.	<u> N </u>	<u> N </u>
Were the required Temp & pH maintained throughout the entire protocol?	<u> Y </u>	<u> Y </u>

Note, details:

 C-1 is 75% IP CONTROL STOCK & 25% IGI CONTROL STOCK

 T-1 is 80% of IP/IGI BLEND & 20% NANOZEO TREATED STOCK

WESTERN MICHIGAN UNIVERSITY



Trial: NANOZEO

Date Run: 10/13-14/09

Sample: C-1 T-1

Was TAPPI T-205 used to form the handsheets, and were temp & pH maintained, dried to 7% moisture content under restraint at 250-275°F, per App. B, #8? Yes

Product Performance

1. Slide Angle T-815 (Note: Test blotter side to blotter side.)

Control Handsheet #	Test Data (°)	Recyclability Test Sample Handsheet #	Test Data (°)
<u>C-1-21,C-1-5</u>	<u>30</u>	<u>T-1-9,T-1-3</u>	<u>33.5</u>
<u>C-1-27,C-1-20</u>	<u>33</u>	<u>T-1-1,T-1-10</u>	<u>31</u>
<u>C-1-14,C-1-22</u>	<u>34.5</u>	<u>T-1-20,T-1-4</u>	<u>33</u>
<u>C-1-3,C-1-7</u>	<u>38</u>	<u>T-1-6,T-1-24</u>	<u>26</u>
<u>C-1-13,C-1-2</u>	<u>32</u>	<u>T-1-13,T-1-14</u>	<u>27</u>
Average _C = <u>33.5 °</u>		Average _R = <u>30.1 °</u>	
85% Average _C = <u>28.475 °</u>			

Test: Is 30.1° >= 28.475° ? Yes
 Initials: DRH

2. Water-Drop Penetration T-831 (Note: Test five drops each on the wire and on the blotter sides.)

Control Handsheet #	Test Data (sec)		Recyclability Test Sample Handsheet #	Test Data (sec)	
	Wire	Blotter		Wire	Blotter
<u>C-1-13</u>	<u>4.04</u>	<u>3.88</u>	<u>T-1-13</u>	<u>5.54</u>	<u>6.26</u>
<u>C-1-3</u>	<u>4.04</u>	<u>3.86</u>	<u>T-1-6</u>	<u>4.58</u>	<u>4.52</u>
<u>C-1-14</u>	<u>4</u>	<u>3.36</u>	<u>T-1-20</u>	<u>4.54</u>	<u>3.86</u>
<u>C-1-27</u>	<u>3.46</u>	<u>3.56</u>	<u>T-1-1</u>	<u>5.22</u>	<u>4.46</u>
<u>C-1-21</u>	<u>3.86</u>	<u>3.58</u>	<u>T-1-9</u>	<u>5.28</u>	<u>3.96</u>
Average _C of 10 drops = <u>3.764 sec</u>			Average _R of 10 drops = <u>4.822 sec</u>		
200 + Average _C = <u>203.764 sec</u>					

Test: Is 4.822sec <= 203.764 sec ? Yes
 Initials: DRH



TEST REPORT: PRODUCT PERFORMANCE (CONTINUED) AND APPEARANCE

Trial: NANOZEO

Date Run: 10/13-14/09

Sample: C-1 T-1

3. Short Span Compression (STFI) T-826

Control				Recyclability Test Sample			
Handsheet #	Basis Wt.	STFI Value	Indexed Value	Handsheet #	Basis Wt.	STFI Value	Indexed Value
C-1-4	35.1	18.32	0.52194	T-1-2	32	16.35	0.51094
C-1-6	33.8	17.62	0.5213	T-1-11	33	17.75	0.53788
C-1-17	34.7	17.52	0.5049	T-1-16	31.5	15.73	0.49937
C-1-18	34.3	17.66	0.51487	T-1-23	30.6	15.54	0.50784
C-1-25	32.5	17.88	0.55015	T-1-27	31.7	16.81	0.53028
			#DIV/0!				#DIV/0!
Average = 34.08 17.8 0.52263				Average = 31.76 16.436 0.51726			

Is the indexed STFI of the treated recyclability test sample no more than 10% lower than the untreated control test sample? Yes

Initials: DRH

Notes:

4. Burst Strength T-403

Control				Recyclability Test Sample			
Handsheet #	Basis Wt.	Burst Value	Indexed Value	Handsheet #	Basis Wt.	Burst Value	Indexed Value
C-1-5	34.3	89	17.8902	T-1-14	32.3	87.25	18.6244
C-1-20	34.5	92.75	18.5359	T-1-24	32.9	87	18.2323
C-1-22	35	92	18.1234	T-1-4	32.5	84	17.8203
C-1-2	34.8	88.75	17.5836	T-1-10	32.4	89.25	18.9925
C-1-7	34.5	88.5	17.6866	T-1-3	32.2	86.75	18.5752
			#DIV/0!				#DIV/0!
Average = 34.62 90.2 17.9638				Average = 32.46 86.85 18.4489			

Is the indexed burst of the treated recyclability test sample no more than 10% lower than the untreated control test sample? Yes

Initials: DRH

Notes:

Product Appearance

STICKIES/SPOT COUNT TEST VALUES AVERAGE COUNT FOR THREE SHEETS

Material	Trial #1	Trial #2	Trial #3	Average
Control	5	2	2	3.0
Test Sample	2	4	3	3.0

Is the spot count ≤ 15 , or, no more than 30% greater than the control?

YES
Initials: DRH

WESTERN MICHIGAN UNIVERSITY



REPORT RESULTS: RECYCLABILITY PROCESS (PART 2)

Trial: NANOZEO

Date Run: 10/13-14/09

Sample: C-2 T-2

	Untreated Control	Recyclability Test Sample
Is sample representative of the lot as a whole?	<u>Y</u>	<u>Y</u>
Moisture Content	<u>7.60%</u>	<u>9.00%</u>
Pulping		
At 3% Consistency?	<u>Y</u>	<u>Y</u>
20/80% Charged by weight?		<u>Y</u>
If greater than 20/80%, specify ratio here:		_____%
Temp & pH maintained, per App. B, #3?	<u>Y</u>	<u>Y</u>
Number of batches required?	<u>1</u>	<u>1</u>
0.0625 Screens		
1% (note if different) Consistency, Temp & pH, per App. B, #5?	<u>Y</u>	<u>Y</u>
10% Volumetric Reject Rate?	<u>Y</u>	<u>Y</u>
0.010 Basket:		
Temp, pH, & Reject Rate, per App B, #6?	<u>Y</u>	<u>Y</u>
Reverse Cleaners:		
Temp & Pressure Differential, per App B, #7?	<u>Y</u>	<u>Y</u>
Determine Volumetric Reject Rate	<u>18.1</u>	<u>20.2 gpm</u>
Was it necessary to stop the test to clean any apparatus at any time during this procedure?	<u>N</u>	<u>N</u>
Disposition observed? If yes, note detail below.	<u>N</u>	<u>N</u>
Were the required Temp & pH maintained throughout the entire protocol?	<u>Y</u>	<u>Y</u>

Note, details:

C-2 is 75% IP CONTROL STOCK & 25% IGI CONTROL STOCK

T-2 is 80% of IP/IGI BLEND & 20% NANOZEO TREATED STOCK



Trial: NANOZEO

Date Run: 10/13-14/09

Sample: C-2 T-2

Was TAPPI T-205 used to form the handsheets, and were temp & pH maintained, Yes
 dried to 7% moisture content under restraint at 250-275°F, per App B, #8?

Product Performance

1. Slide Angle T-815 (Note: Test blotter side to blotter side.)

Control Handsheet #	Test Data (°)	Recyclability Test Sample Handsheet #	Test Data (°)
<u>C-2-7, C-2-1</u>	<u>27</u>	<u>T-2-14, T-2-24</u>	<u>33</u>
<u>C-2-15, C-2-9</u>	<u>32</u>	<u>T-2-2, T-2-11</u>	<u>34</u>
<u>C-2-6, C-2-21</u>	<u>31</u>	<u>T-2-20, T-2-22</u>	<u>35.5</u>
<u>C-2-13, C-2-16</u>	<u>35.5</u>	<u>T-2-8, T-2-4</u>	<u>37</u>
<u>C-2-23, C-2-27</u>	<u>35</u>	<u>T-2-18, T-2-10</u>	<u>34</u>
Average _C = <u>32.1 °</u>		Average _R = <u>34.7 °</u>	
85% Average _C = <u>27.285 °</u>			

Test: Is 34.7° >= 27.285°? Yes
 Initials: DRH

2. Water-Drop Penetration T-831 (Note: Test five drops each on the wire and on the blotter sides.)

Control Handsheet #	Test Data (sec)		Recyclability Test Sample Handsheet #	Test Data (sec)	
	Wire	Blotter		Wire	Blotter
<u>C-2-23</u>	<u>4.02</u>	<u>3.26</u>	<u>T-2-18</u>	<u>3.58</u>	<u>2.9</u>
<u>C-2-13</u>	<u>3.34</u>	<u>3.64</u>	<u>T-2-8</u>	<u>4.54</u>	<u>5.28</u>
<u>C-2-6</u>	<u>3.32</u>	<u>2.86</u>	<u>T-2-20</u>	<u>3.44</u>	<u>3.1</u>
<u>C-2-15</u>	<u>4.56</u>	<u>4.84</u>	<u>T-2-2</u>	<u>5.28</u>	<u>5.28</u>
<u>C-2-7</u>	<u>3.4</u>	<u>2.96</u>	<u>T-2-14</u>	<u>3.42</u>	<u>3.4</u>
Average _C of 10 drops = <u>3.62 sec</u>			Average _R of 10 drops = <u>4.022 sec</u>		
200 + Average _C = <u>203.62 sec</u>					

Test: Is 4.022sec <= 203.62 sec? Yes
 Initials: DRH



TEST REPORT: PRODUCT PERFORMANCE (CONTINUED) AND APPEARANCE

Trial: NANOZEO

Date Run: 10/13-14/09

Sample: C-2 T-2

3. Short Span Compression (STFI) T-826

Control				Recyclability Test Sample			
Handsheet #	Basis Wt.	STFI Value	Indexed Value	Handsheet #	Basis Wt.	STFI Value	Indexed Value
C-2-5	31.8	15.89	0.49969	T-2-5	32.2	16.55	0.51398
C-2-14	32.5	18.22	0.56062	T-2-12	32.8	16.69	0.50884
C-2-19	32.4	17.12	0.5284	T-2-17	31.7	16.79	0.52965
C-2-22	32.5	16.77	0.516	T-2-21	32.3	16.68	0.51641
C-2-26	32.6	16.71	0.51258	T-2-27	33	16.65	0.50455
			#DIV/0!				#DIV/0!

Average = 32.36 16.942 0.52345 Average = 32.4 16.672 0.51468

Is the indexed STFI of the treated recyclability test sample no more than 10% lower than the untreated control test sample? Yes

Initials: DRH

Notes:

4. Burst Strength T-403

Control				Recyclability Test Sample			
Handsheet #	Basis Wt.	Burst Value	Indexed Value	Handsheet #	Basis Wt.	Burst Value	Indexed Value
C-2-1	31.8	81.25	17.6163	T-2-10	32	84.5	18.2065
C-2-9	33	85.75	17.9159	T-2-4	32	83.75	18.0449
C-2-27	32.3	83.5	17.8239	T-2-22	33	87.5	18.2816
C-2-16	31.8	79.25	17.1827	T-2-11	33.4	92	18.9916
C-2-21	31.9	78.5	16.9667	T-2-24	32.1	84.5	18.1498
			#DIV/0!				#DIV/0!

Average = 32.16 81.65 17.5011 Average = 32.5 86.45 18.3348

Is the indexed burst of the treated recyclability test sample no more than 10% lower than the untreated control test sample? Yes

Initials: DRH

Notes:

Product Appearance

STICKIES/SPOT COUNT TEST VALUES AVERAGE COUNT FOR THREE SHEETS

Material	Trial #1	Trial #2	Trial #3	Average
Control	0	2	3	1.7
Test Sample	0	5	5	3.3

Is the spot count ≤ 15 , or, no more than 30% greater than the control? YES

Initials: DRH

WESTERN MICROFILMS LIMITED



PASS/FAIL SUMMARY

	Trial #1	Trial #2	Trial #3
1. For both treated and untreated were the substrate, samples, specimens appropriate?	<u>Yes</u>	<u>Yes</u>	<u> </u>
2. Fibre Yield \geq 85% ?	<u>Yes</u>	<u>Yes</u>	<u> </u>
3. Operational impact acceptable?	<u>Yes</u>	<u>Yes</u>	<u> </u>
4. Product performance acceptable?	<u>Yes</u>	<u>Yes</u>	<u> </u>
5. Product appearance/spot count acceptable?	<u>Yes</u>	<u>Yes</u>	<u> </u>
Overall Pass / Fail - by trial:	<u>Pass</u>	<u>Pass</u>	<u> </u>

MATERIAL AS SUBMITTED "PASSES" VOLUNTARY STANDARD.

Select Pass or Fail: Pass

Signed: _____

Print name: Joel Kendrick



TEST REPORT (CONTINUED)

Affirmation:

The facilities and equipment in this lab are suitable for testing the tendered product tolerances of the current voluntary standard.

Personnel running and reporting these tests are competent and trained to accurately do so. They have within the instructions and followed the letter and spirit of the subject voluntary standard.

Objective and subjective information, as contained herein, is accurate.

Signed:  Lab Manager
Joel Kendrick Print name
Director Pilot Plants Title
269-276-3533 Phone
10/30/09 Date

Pilot Plants
4651 Campus Dr.
Kalamazoo, MI 49008



MATERIAL SUBMISSION INFORMATION
Submitted Information.

Company Name: CHT COMPANY LTD
DBA (if applicable): _____
Division (if applicable): Green Technology Dept. (TMIT)
Contact Name: Raymond Wang
Position: Director of Green Technology Dept.
Address: 7FL, KUNYANG BLDG, NO.789 ZHAO JIA BANG RD. XU HUI DISTRICT, SHANGHAI, 200030 CH
Phone: 86-21-51793799 Fax: _____ e-mail: raymond@nanozeo.com

Treatment/Product Information:

Product Name: ZEO cardboard

Treatment Type, i.e., emulsion (aqueous), modified wax, solvent-based coating, other:
modified starch adhesive glue mixed with ZEO-lite stone powder

Intended Application Method, i.e., cascaded, dip, surface coated, impregnated, other:
ZEO-lite stone coating applied on medium/flute

(If more than one method is proposed, multiple submissions or "toughest" case must be submitted.)

Maximum treatment weight per 1,000 sq. ft. of combined board 0.51 lbs.

Affirmation: *To be signed by person who is an officer of the above company and authorized to represent/bind the above company.*

Check Option A or Option B: **A**

Option A: _____

- All materials and information submitted to the lab and FBA for the purposes of testing and certification of the above product are accurate as represented above.
- Appropriate company personnel have thoroughly read and understood the voluntary standard, and have prepared and submitted materials and information in accordance with the standard.
- Treated corrugated products represented (by this company or licensee), as certified to the voluntary standard, meet and will continue to meet the certification and marking sections of the standard as they are manufactured, tendered for commerce and enter the recycling stream.

Option B: _____

- These treated corrugated products are being certified based on testing done by another company or another location of this company. We will manufacture them with similar substrates and will have the same strength to weight ratio as the corrugated products originally certified.

Signed: 

Date: 10/29/2009

Name: Raymond Wang

Phone: 86-21-51793799

Title: Director of Green Technology Dept. (TMIT)

SUBSTRATE AND TREATMENT DETAILS

Company: CHT COMPANY LTD (TMIT)

Product: ZEO carboard

	COMPONENT	BASIS WEIGHT (LBS/MSF)	MILL SOURCE (OPTIONAL)	TREATMENT(S) (LIST ALL)	PROCESS(ES) (LIST ALL)	NOTES
SINGLEWALL	Outer Liner					
	Medium					
DOUBLEWALL	Inner/ Center Liner	41/19.5				
	*Medium	19.5		modified starch adhesive glue mixed with ZEO-lite stone powder for reinforcement	ZEO-lite stone powder coating applied with adhesive on flute/medium during normal operation	
	*Inner Liner	28.7				
COMBINED BOARD						

*List all treatments that have been applied, including wet strength, adhesive, color, and how applied (i.e., cascaded, extruded), or where (such as "paper mill").

Completed by: Raymond Wang/CHT COMPANY LTD (TMIT)

Date: 9/17/2009

Phone: 86-21-51793799