

TEST REPORT



Your Ref : Date : 2000-07-24

Our Ref : 1550003496.1 ST KSY/LHF/ISNART Page : 1 of 8
(Please quote this ref. no. in reply)

DID : 7729582 Fax : 7794359

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DETERMINATION OF ACRYLIC MATERIALS

Client : Red Coral Aquatic Tech, Development Co., Ltd
No. 52 Hua Ling Xi Road
Hua Xin Yuan
Shanghai
PRC

Attn : Mr Shen Yi Xuan

Background :

The following red coral aquatic acrylic sheets were received on 2000-05-27 for evaluation.

| <u>Approximate Sample dimensions</u> | <u>Qty</u> |
|--------------------------------------|------------|
| 180mm x 100mm x 10mm | 1 piece |
| 180mm x 120mm x 10mm | 1 piece |
| 200mm x 150mm x 10mm | 1 piece |
| 225mm x 120mm x 10mm | 1 piece |
| 250mm x 200mm x 3mm | 1 piece |
| 320mm x 180mm x 3mm | 1 piece |
| 400mm x 160mm x 3mm | 1 piece |

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Test methods :

1. Haze

ASTM D1003 : 1997

Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

Instrument used : Perkin-Elmer UV/VIS/NIR Spectrophotometer (with
integrating sphere attachment), model : Lambda 19
Wavelength : 190nm – 2500nm
Test conditions : a) Illuminant : C
b) Observer : 2°

2. Refractive Index

Equipment : Abbe Refractometer
Accuracy : ± 0.0003
Test temperature : 22°C
Wavelength : 589.3nm

3. Shore Hardness

ASTM D2240 : 1997

Standard Test Method for Rubber Property – Durometer Hardness

Test conditions

Nominal specimen thickness : 3mm
No. of plies : 1
Time interval for each reading to be
taken : 1 second
No. of determinations : 7

4. Thermomechanical Analysis (TMA)

Load used : 0.02N
Temperature range : Ambient to 250°C
Heating rate : 10°C/min

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Test methods : (cont'd)

5. Water Absorption

ASTM D570 : 1995

Standard Test Method for Water Absorption of Plastics

| | | |
|----------------------------------|---|-----------------------|
| Nominal specimen dimensions | : | 76.2mm x 25.4mm x 3mm |
| Conditioning of test specimens | : | 50 ± 2°C for 24 ± 1h |
| Immersion medium | : | Distilled water |
| Reconditioning of test specimens | : | 50 ± 2°C for 24 ± 1h |
| No. of determinations | : | 3 |

6. Heat Deflection Temperature

ASTM D648 : 1998c

Standard Test Method for Deflection Temperature of Plastics Under Flexural Load

| | | |
|-----------------------------|---|--------------------|
| Nominal specimen dimensions | : | 130mm x 13mm x 3mm |
| Maximum fibre stress | : | 1.82kPa |
| Heat transfer medium | : | Silicone oil |
| No. of determinations | : | 2 |

7. Izod Impact Strength

ASTM D256 : 1997

Standard Test Methods for Impact Resistance of Plastics and Electrical Insulating

| | | |
|-----------------------------|---|-------------------|
| Nominal specimen dimensions | : | 64mm x 13mm x 3mm |
| Capacity of pendulum | : | 2.7J |
| No. of determinations | : | 10 |

8. Compressive Strength

ASTM D695 : 1996

Standard Test Method for Compressive Properties of Rigid Plastics

| | | |
|-----------------------------|---|------------------------|
| Nominal specimen dimensions | : | 12.5mm x 12.5mm x 50mm |
| Crosshead speed | : | 1.3mm/min |
| No. of determinations | : | 5 |

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Test methods : (cont'd)

9. Tensile Properties

ASTM D638 : 1998

Standard Test Method for Tensile Properties of Plastics

Test conditions

| | | |
|-----------------------|---|------------------------|
| Type of specimen | : | Dumbbell shape, Type I |
| Gauge length | : | 50mm |
| Grip length | : | 115mm |
| Cross head speed | : | 50mm/min |
| No. of determinations | : | 5 |

10. Flexural Strength and Modulus of Elasticity

ASTM D790 : 1998

Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics
and Electrical Insulating Materials

| | | |
|-----------------------------|---|----------------------|
| Nominal specimen dimensions | : | 127mm x 12.7mm x 3mm |
| Support span | : | 50mm |
| Crosshead speed | : | 1.39mm/min |
| No. of determinations | : | 5 |

11. Flammability Test

ASTM D635 : 1998

Standard Test Method for Rate of Burning and / or Extent and Time of Burning of
Plastics in a Horizontal Position

| | | |
|-------------------------------|---|----------------------------------------------------------|
| Nominal Specimen dimensions | : | 125 ± 5mm x 13.0 ± 0.5mm x 3mm |
| Conditioning of test specimen | : | 23 ± 2°C / 50 ± 5% RH for 48h (min.) prior to testing |
| Gas supply | : | Town gas |
| No. of determinations | : | 10 |

Test methods : (cont'd)

12. Thermal Conductivity

ASTM C518 : 1991

Standard Test Method for Steady-State Thermal Transmission Properties by means of the Heat Flow Meter

The thermal conductivity of the material was measured by using a heat flow meter calibrated with a standard fibreglass sample of thickness of 25mm and thermal conductivity of 0.03480W/m²K at mean temperature of 23.32°C.

13. Odour and Taste

SS 375 : 1974

Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water

Part 2 : Method of test - taste of coater - general method of test

Remark : Unless otherwise stated, all the test specimens were conditioned at 23 ± 2°C / 70 ± 15% RH and tested at 23 ± 2°C / 65 ± 5% RH.


Results :

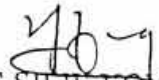
| Characteristics | Red Coral Aquatic Acrylic Sheet |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1a. Total Transmission (%) | 92.4 |
| 1b. Haze (%) | 0.3 |
| 2. Refractive Index | 1.4905 |
| 3. Shore D Hardness, median | 91 |
| 4a. Coefficient of Thermal Expansion (cm/cm°C) i) α_1 (30 – 80°C) ii) α_2 (117 – 124°C) | 9.7 x 10 ⁻⁵ 2.4 x 10 ⁻³ |
| 4b. Transition Temperature (onset), °C | 116 |
| 5. Water Absorption (%), average | 0.13 |
| 6. Heat Deflection Temperature (°C), average | 103 |
| 7. Izod Impact Strength (J/m), average | 25.8 |
| 8. Compressive Strength (N/mm ²), average | 12.8 |
| 9a. Maximum Tensile Strength (kg/cm ²), average | 692.4 |
| 9b. Modulus of Elasticity (kg/cm ²), average | 16684.7 |
| 9c. Elongation at Break (%), average | 4.2 |
| 10a. Flexural Strength (kg/cm ²), average | 1205.0 |
| 10b. Flexural Modulus (kg/cm ²), average | 28612.2 |
| 11. Average burning rate (cm/min) | 0.7 |
| 12. Thermal Conductivity Test | |
| a) Dimension of specimen (mm) | 300.9 x 300.5 x 24.1 |
| b) Density (kg/m ³) | 1174.92 |
| c) Temperature of hot face (°C) | 33.60 |
| d) Temperature of cold face (°C) | 13.20 |
| e) Mean Temperature (°C) | 23.40 |
| f) Thermal Conductivity W/m ² K (Kcal/mh ² K) | 0.1146 (0.0985) |
| 3. Odour and Taste | The taste panellist did not detect a taste in the first dilutions of the first 24hr unchlorinated and chlorinated extracts for all the above three samples. |

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Notes:

- (a) The TMA thermogram was shown in Figure 1.
- (b) For odour and taste test, the results obtained show that the product complies with the requirements of SS 375 : Part 3.1 for the taste of water test.
- (c) The results were released to the client by telefax on 30/06/2000 and 14/07/2000 respectively.


EDDIE SUWAND
TECHNICAL EXECUTIVE


KONG SIEW YONG
ASST. TEAM LEADER
MATERIALS & CHEMICAL
DIAGNOSIS CENTRE

Sample: Acrylic Sheet (China)
Size: 3.3222 mm
Method: Micron

TMA

File: D:\TMA\leong\C.01
Operator: KSY
Run Date: 1-Jun-00 14:31

Singapore Productivity
and Standards Board

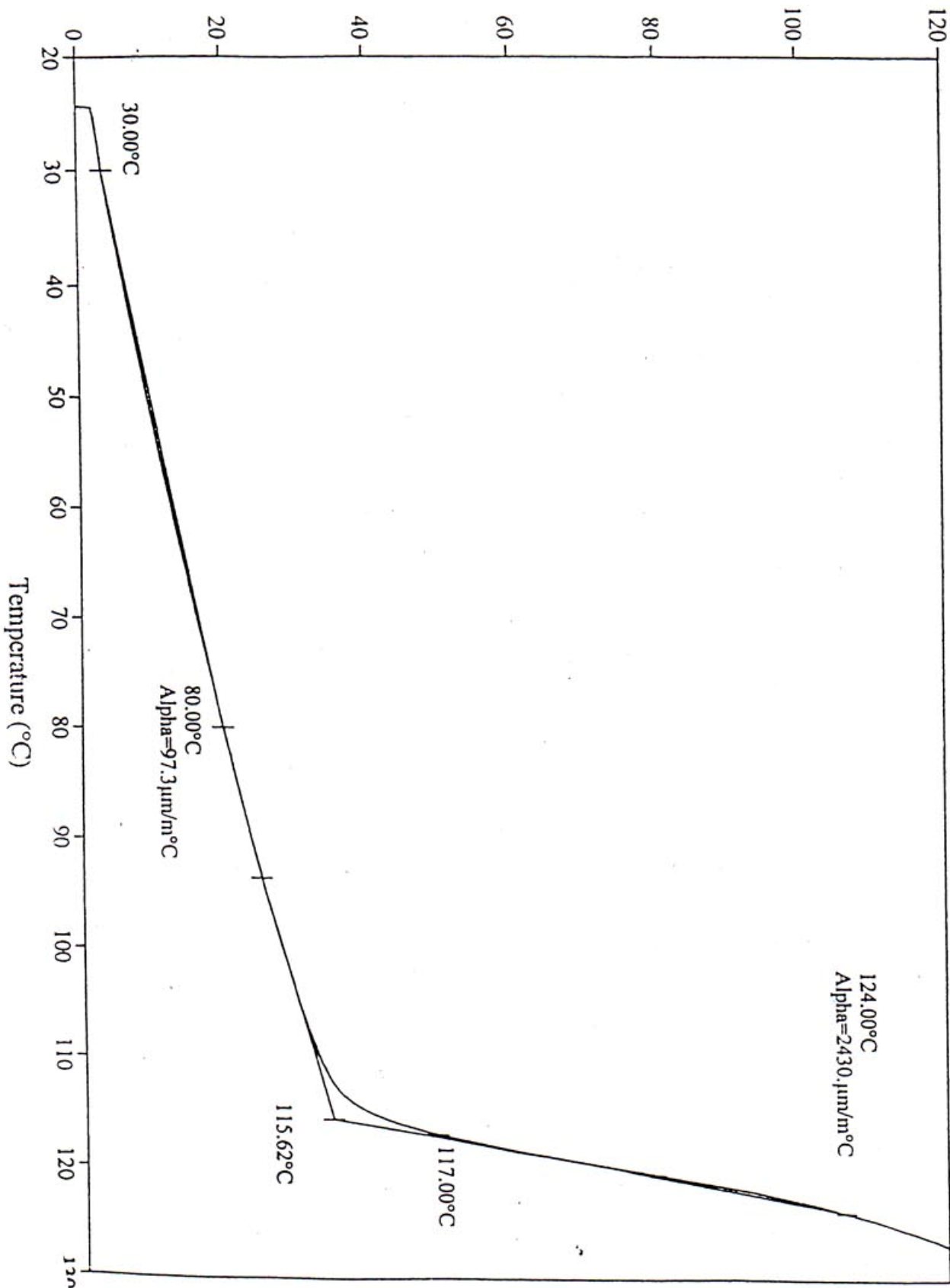


Figure 1 : TMA Thermogram of Red Coral Aquatic Acrylic Sheet

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Sample: Acrylic Sheet (China)
Size: 3.3222 mm
Method: Micron

TMA

File: D:\TMALLcong\C.01
Operator: KSY
Run Date: 1-Jun-00 14:31

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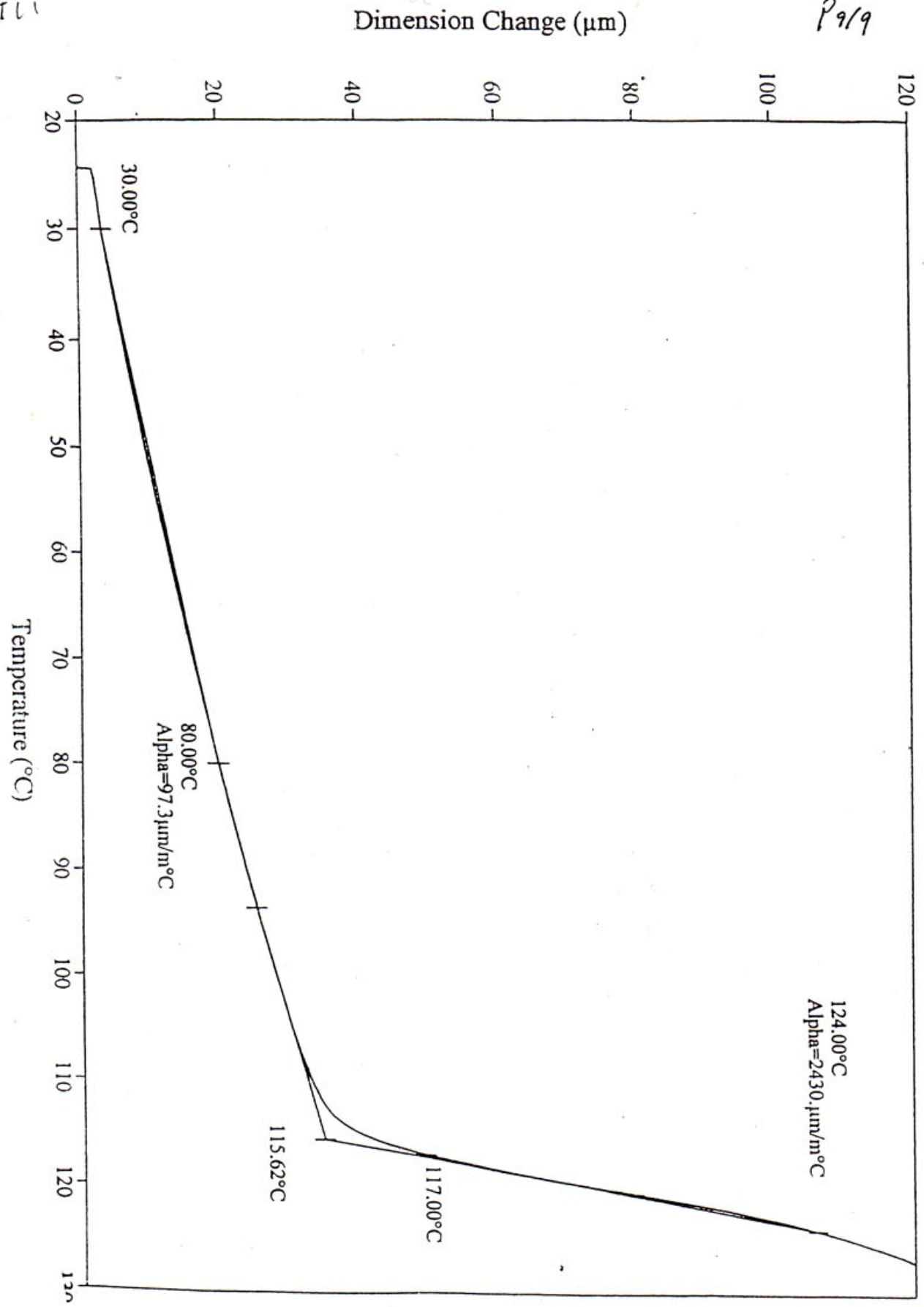


Figure 1 : TMA Thermogram of Red Coral Aquatic Acrylic Sheet