

SPECIFICATION

**Tigold METAMODE™ HEA® or CHEA® COATINGS
ON PLASTIC SUBSTRATES WITH PRINTFREE™ OPTION
4-3-03-006**

PROPRIETARY YES NO



For additional information or to purchase please contact:

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REV	DATE	DESCRIPTION	WRITTEN BY
Original	12/21/01	Issued	Yu Kitsuno
A	2/22/02	Revised Spectral Properties	Yu Kitsuno
B	6/23/03	Revised Spectral Properties	Yu Kitsuno
C	4/13/04	Revised Company name	Yu Kitsuno
AUTHORIZED FOR RELEASE BY:			RELEASE DATE:
PRODUCT MANAGER			April 13, 2004

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INDEX OF PRODUCTS

Substrate (Product)	Design	PrintFree™	Attribute	Summery Tables
Rigid Plastics (HEA Protect®)	HEA®	YES	Surface quality	A
			Spectral properties	D
			Durability & cleanability	H
	CHEA®	YES	Surface quality	A
			Spectral properties	D
			Electrical properties	G
			Durability & Cleanability	H
	Flexible Plastic Films (HEA 2000®, CHEA 2000®)	HEA®	YES	Surface quality
Spectral properties				E
Durability & Cleanability				H
CHEA®		YES	Surface quality	B
			Spectral properties	E
			Electrical properties	G
			Durability & Cleanability	H
Linear Polarizer		HEA®	YES	Surface quality
	Spectral properties			F
	Durability & Cleanability			H
	CHEA®	YES	Surface quality	C
			Spectral properties	F
			Electrical properties	G
			Durability & Cleanability	H

1. Scope

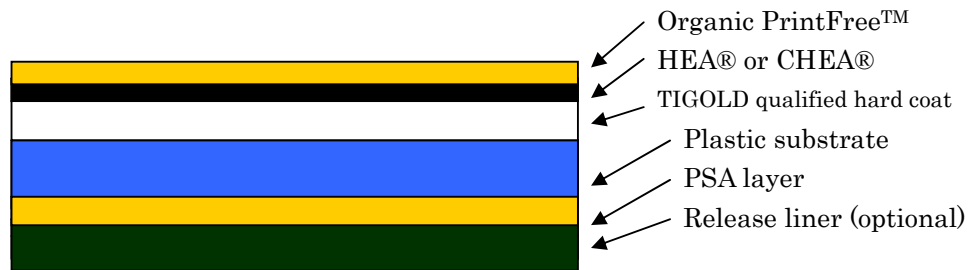
This specification applies to the requirements of the HEA® or CHEA® coatings, with PrintFree™ option, using the TIGOLD MetaMode™ sputtering deposition process applied to plastic substrates.

Some substrates may have a Pressure Sensitive Adhesive herein referred to as “PSA”.

2. Construction and dimensions

2.1 Construction

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2.2 Dimensions

TIGOLD shall coordinate dimensional requirements with each customer product in order to maximize both TIGOLD and customer processing utilization. Maximum size will depend on thickness of substrate. In general for substrates 1.5mm or less, the maximum dimensions are 1080mm x 500mm (1080mm x 480 mm minimum with TIGOLD coating). For substrates thicker than 1.5mm up to 5mm the maximum dimensions are 900mm x 330mm (900mm x 310 mm minimum with TIGOLD coating).

3. Appearance, Spectral Properties, and Durability

3.1 Appearance

3.1.1 Cosmetic quality defects in the MetaMode™ HEA® or CHEA® coatings, with PrintFree™ option, shall be monitored for each product type. A sampling plan for each particular substrate may be developed between TIGOLD and customer.

3.1.2 The appearance of the product shall be evaluated using the tables below as described in section 4.1.

RIGID PLASTICS (thickness of substrate more than 0.3mm) Table A

Property	Size	Specification (based on 200mm x 200mm)	Test Method
Pinholes	>630µm	Non allowed	See 4.1.1
	≥380µm to ≤630µm	No more than 4	
	<380µm	No limit, except that a cluster of small pinholes shall be counted as a single defect toward the total	
Scratch	>130µm wide	Non allowed	See 4.1.2
	≥50µm to ≤130µm	No more than 4 with minimum separation of 25mm.	
	<50µm	Disregard	

Note#1: Substrate related defects shall be disregarded for customer furnished substrate.

Note#2: The size of pinhole defect, ϕ (diameter), shall be $\phi = (\text{Length} + \text{Width})/2$.

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Note#3: Judgment of other defects shall be made from time to time by samples prepared specially for that purpose.

Flexible Plastic Films (HEA2000®, CHEA2000®) Table B

Property	Size	Specification (based on 250mm x 185mm)	Test Method
Pinholes	>630µm	Non allowed	See 4.1.1
	≥380µm to ≤630µm	No more than 4	
	≥250µm to <380µm	No more than 30	
	<250µm	No limit, except that a cluster of small pinholes shall be counted as a single defect toward the total	
Scratch	>130µm wide	Non allowed	See 4.1.2
	≥50µm to ≤130µm	No more than 4 with minimum separation of 25mm.	
	<50µm	Disregard	
Tunneling		None allowed	

Note#1: Substrate related defects shall be disregarded for customer furnished substrate.

Note#2: The size of pinhole defect, ϕ (diameter), shall be $\phi = (\text{Length} + \text{Width})/2$.

Note#3: Judgment of other defects shall be made from time to time by samples prepared specially for that purpose.

Note#4: Tunneling is the separation of the release liner from SPA surface creating a long thin bubble.

LINEAR POLARIZERS Table C

Property	Size	Specification (based on 500mm x 1000mm)	Test Method
Pinholes	≥75µm	No more than 12	See 4.1.1
	<75µm	No limit	
Scratch	>25µm wide	Non allowed	See 4.1.2
Tunneling		None allowed	

Note#1: Substrate related defects shall be disregarded for customer furnished substrate.

Note#2: The size of pinhole defect, ϕ (diameter), shall be $\phi = (\text{Length} + \text{Width})/2$.

Note#3: Judgment of other defects shall be made from time to time by samples prepared specially for that purpose.

Note#4: One to three defects within a 2cm circle shall be counted as one defect.

Note#5: Four or more defects within a 5cm circle shall be counted as four defects.

Note#6: Tunneling is the separation of the release liner from SPA surface creating a

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long thin bubble.

3.2 Spectral & Electrical Properties

As needed, special spectral & electrical characteristics of HEA® or CHEA® coatings, with PrintFree™ option, will be determined, recommended and implemented as a result of mutual agreement between TIGOLD and customer. The maximum brightness

and resistivity allowed is given below:

RIGID PLASTICS (thickness of substrate more than 0.3mm) Table D

Properties	Unit	Specification	Test Method
Reflected Brightness	%	0.70% or less for Clear	See 4.2
Reflected Brightness	%	0.50% or less for Haze 13%	See 4.2

Flexible Plastic Films (HEA2000®) Table E-1

Properties	Unit	Specification	Test Method
Reflected Brightness	%	0.60% or less for Clear	See 4.2
Reflected Brightness	%	0.50% or less for haze 5.5%	See 4.2
Reflected Brightness	%	0.50% or less for haze 10.4%	See 4.2

Flexible Plastic Films (CHEA2000®) Table E-2

Properties	Unit	Specification	Test Method
Reflected Brightness	%	0.80% or less for Clear	See 4.2
Reflected Brightness	%	0.70% or less for haze 5.5%	See 4.2
Reflected Brightness	%	0.70% or less for haze 10.4%	See 4.2

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LINEAR POLARIZERS

Table F

Properties	Unit	Specification	Test Method
Reflected Brightness	%	0.375% or less	See 4.2
Reflected Color	1931xyCIE	If specified, Within boundaries Defined by below: x=0.190 y=0.050 x=0.320 y=0.090 x=0.360 y=0.140 x=0.330 y=0.270 x=0.270 y=0.250 x=0.180 y=0.130 x=0.180 y=0.090 x=0.190 y=0.050	See 4.3

RIGID PLASTICS, CHEA2000®, LINEAR POLARIZERS

Table G

Properties	Unit	Specification	Test Method
Resistivity	Ohms per Square	100 to 500 Ohms per Square nominal	See 4.35

3.3 Coating durability

3.3.1 Durability performance of TIGOLD MetaMode™ HEA® or CHEA® coatings, with PrintFree™ option.

*The durability tests described shall be performed only after the moisture content of the TIGOLD HEA® coating and the base substrate system has returned to a “normal” condition (typically 24 hours after coating).

RIGID PLASTICS, Flexible Plastic Films (HEA2000®, CHEA2000®),

LINEAR POLARIZERS

Table H

Properties	Test Conditions**	Test Method
Adhesion	Snap tape with #600 cellulose tape pressed against coated surface and remove with snap of wrist.	See 4.4
Pen Cleanability - PrintFree™ option	Mark the surface of PrintFree™ HEA® with a Zebra® black ink pen.	See 4.5
Contact Angle - PrintFree™ option	Contact angle of PrintFree™ HEA® coating or CHEA® coating to be 110 degrees or better.	See 4.6

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4.1.2 Scratch

Inspection for scratches shall be performed visually at a distance of approximately 30cm from the specimen under 30-40 watt cool white fluorescent lights (covered with an opaque white diffuser) so that illumination of approximately 2500 Lux is provided.

4.2 Reflected Luminance (brightness)

The specular reflectance of linear polarizers and other substrates coated with HEA® or CHEA® coatings, with PrintFree™ option, shall be measured at a 10° incident angle from the normal. The specular reflected luminance (reflectance weighted by the photopic eye response and the illuminant) shall be calculated from the measured reflectance. Illuminant C shall be used as the weighted light source.

4.3 Reflected Color

The reflected color of substrates coated with HEA® or CHEA® coatings, with PrintFree™ option, shall be calculated from the measured reflectance using a 1931 xy CIE Color Coordinate system with a 2° observer and an illuminant C light source.

4.35 Resistivity

The Resistivity of the CHEA® coating shall be measured with a DELCOM non-contact conductance monitor.

4.4 Adhesion

For Flexible Plastic Films and Linear Polarizers coupons, approximately 30mm wide, may be submitted to test from different areas at one edge of one sheet per run. Samples will be used for testing adhesion, boil, rub durability and contact angle verification. Rigid substrates may use coupons (approx. 75mm x 150mm) for adhesion testing. These coupons will be representative of specific areas of whole coated sheet. The samples of the coating shall show no evidence of delamination from the hard coated surface of the substrate. The backside (adhesive side) of the #600 tape and the area of the substrate that was tape tested shall be examined for evidence of coating material. The coated surface of Linear Polarizer will be cross-hatched prior to tape testing with a razor knife to produce 2mm square pattern on the coupon.

4.5 Pen Cleanability

After PrintFree™ HEA® or CHEA® coatings, the pen shall leave no visible pen mark when wiped with a class 100 clean room compatible wiper.

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4.6 Contact Angle

The contact angle of a drop of distilled water measured on PrintFree™ HEA® or CHEA® will be 110 degrees or greater. The measurement device is a Kruss G10 Contact Angle Measuring Instrument.

4.7 Abrasion

After boil test, the coating shall show no evidence of permanent deterioration when viewed from a distance of approximately 30cm from the specimen under 30-40 watt cool white fluorescent lights (covered with an opaque white diffuser) so that illumination of approximately 2500 Lux is provided.

4.8 Chemical resistance

The coating shall show no deterioration after a puddle of each of the agents is allowed to remain on the surface for 24 hours. Chemical agents which can only be removed by acetone will not be considered for testing as this would destroy the plastic substrate.

5. Incoming Inspection for (CFM) Customer Furnished Material to be coated

5.1 Definition of Lot

One lot shall consist of the identifiable product of the same type manufactured continuously from the same materials under the same manufacturing condition.

5.2 Manner of Inspection by TIGOLD

Samples from each lot will be brought to a Class 1000 staging area. These will be reviewed for cleanliness before entry into cleanroom.

6. Packaging and Marking

6.1 Packaging TIGOLD to customer

Methods of packaging and marking materials for shipment should be determined for particular types of products. Appropriate interleaving (typically white Tyvek interleaving) will be used. TIGOLD will attempt to recycle any CFM packaging where appropriate.

6.2 Marking

The product shall be legibly identified by TIGOLD to customer with the following information:

- < Customer Name
- < Product Name

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- < Customer Purchase Order
- < Run #
- < Quantity
- < Other identifiables as agreed

6.3 Quality Data and Reports. These issues should be determined separately for each customer. Production history of material can be generated to customer needs.

6.3.1 If any portion of the substrate is defective, it may be marked by customer's request. The marks will show which portion of the sheet is defective. The method of marking may be determined by mutual agreement between TIGOLD and customer.

Supplemental item:

For TIGOLD to ensure that deposition of the HEA® or CHEA® coatings, with PrintFree™ option on a new type of plastic substrate, the substrate will be qualified as a production process to the requirements of this specification. A minimum quantity of full production coating batches in the MetaMode™ machine is required to prove capability. Customer samples may be produced and tested by both the customer and TIGOLD, but until full coating batches are produced and capability established for a particular substrate/coating package, this specification is for testing purpose only.

If Parties desire a modification to this specification both parties must agree in advance.

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