J K PAPER LIMITED

PRESENTATION AT IPPTA, SAHARANPUR

(05/06/2025)

Paper Properties & their Significance

Properties of Paper & Board

- Physical/Chemical Properties
- Strength Properties
- Optical Properties
- Printing Properties

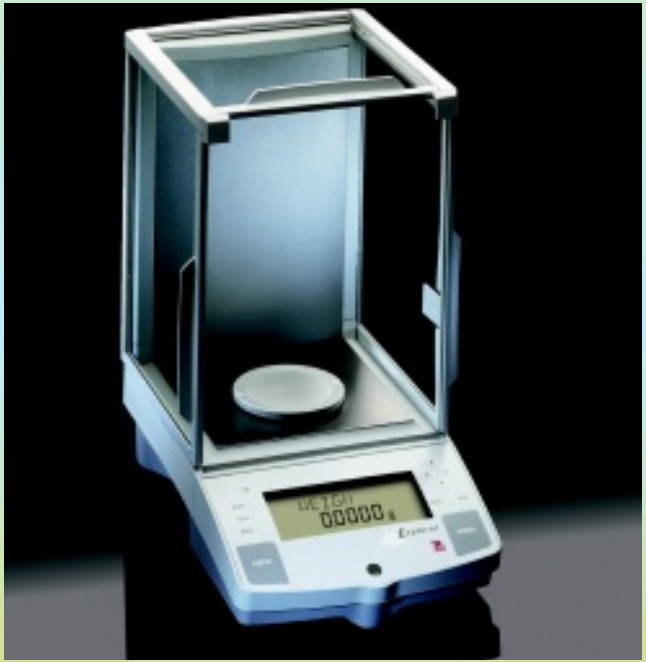
PHYSICAL/CHEMICAL PROPERTIES

- Grammage
- Moisture Content
- Surface Strength(Wax pick)
- Caliper
- Water Absorption(Cobb)
- Water Absorption(Edge Wick)
- Static Charge
- Smoothness(PPS)
- Smoothness(Bendtsen)
- Stiffness(Taber)
- Formation Index
- TSO
- Twist and Curl
- Castor Oil Absorption
- pH

PHYSICAL PROPERTIES

Grammage

- **Significance**
  - Paperboard is sold in accordance with its mass per unit area.
  - Significant to both consumer and producer in defining price
  - Many physical properties are interpreted with regard to Grammage.
- Standard Test procedure references
  - TAPPI T 410
  - ISO 536
  - ASTM D 646-96
  - IS 1060 Part5/Sec5
- Equipment
  - Digital Balance
  - Templates
- Unit of Measurement
  - g/m² (GSM)



PHYSICAL PROPERTIES

Caliper

- Significance
  - Thickness (Caliper) is an important property for paperboard used for mechanical purposes.
  - Highly influences the stiffness of the paperboard
  - Crucial property for determining crease parameters
- Standard Test procedure references
  - TAPPI T 411
  - AS 1301.426s
  - ISO534
  - SCANP7
  - IS 1060 Part5/Sec3
- Equipment
  - Micrometer

PHYSICAL PROPERTIES

Surface Strength (Wax Pick)

- Significance
  - It is the measure of the surface strength of paper/board sheet or resistance to picking. It is done for coated papers/boards.
- Standard Test procedure references
  - TAPPI T-459
  - IS 1060 part-3
- Equipment
  - Wax Sticks
  - Burner
- Unit of Measurement
  - No.

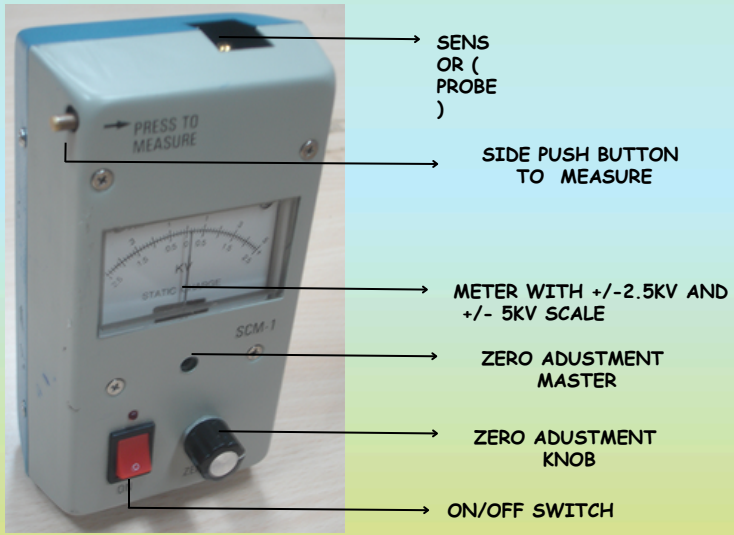
PHYSICAL PROPERTIES

Definition: The localized electric charge developed during the friction between two insulating materials such as textiles, rubber, plastics, paper, dye stuffs, dry organic materials etc is called static charge or electrostatic charge.

Significance:

Static charge in paper tends sticking between two sheets leads to mis feeding, jamming poor photocopying.

Static charge



PHYSICAL PROPERTIES

Smoothness (PPS)

Significance:
This method differs from other air leak roughness measurement techniques in that the dimensions of the measuring land, the clamp pressure and backing material are chosen to simulate conditions in the nip of a printing press.

To simplify comparison with ink film thickness and fiber dimensions the readings are expressed in micrometer.

PPS ISO Method: 8791-4
TAPPI T: 555
IS :IS 1060 Part 5/Sec 17
Equipment Supplier:
Lorentzen & Wettre
Model Code: SE165

PHYSICAL PROPERTIES

Smoothness (Bendtsen)

SIGNIFICANCE: Surface smoothness is known by the measuring Roughness values, which allows to assess the printability as “lower the Roughness better the printing”.

METHOD REFERENCE: QS/TM/48

STANDARD REFERENCE:
ISO 8791 – 2
IS 1060 Part5/Sec20

TESTING EQUIPMENT :
Bendtsen Roughness & Porosity Tester,
L&W Bendtsen Tester.

Other Methods of Testing

- Bekk
- Gurley
- Sheffield

PHYSICAL PROPERTIES

Stiffness (Taber)

Significance:

- Stiffness is the ability of paper to resist bending
- Paper thickness has a big impact on stiffness

Test Methods
TAPPI T: 566
IS : IS 1060 Part-3

Equipment Supplier:
Stiffness Tester

PHYSICAL PROPERTIES

Significance

- To see how uniformly the fiber is distributed per unit area, which gives the better test results and surface texture.

Formation index

- It is most often used to quantify formation quality. A higher Formation Inde a more uniform sheet.

Standard Reference; Internal method

Equipment: Formation tester

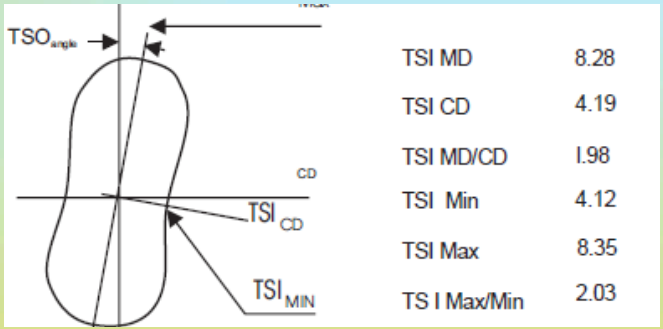
Micro scanner

PHYSICAL PROPERTIES

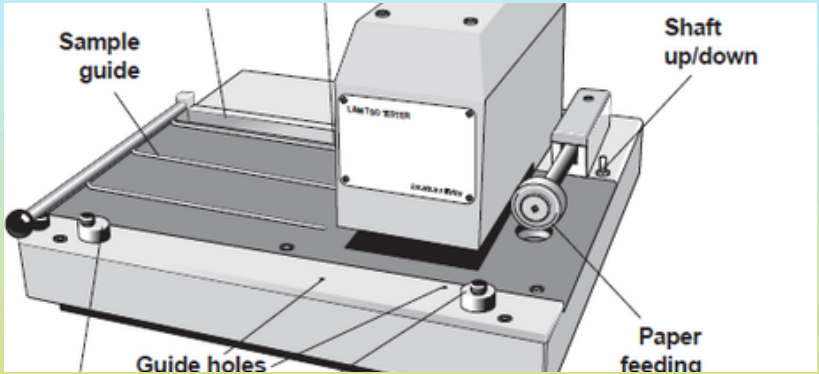
TSO

METHOD REFERENCE : QS/TM/71
STANDARD REFERENCE : Internal method
SIGNIFICANCE :
To see the elastic properties and Tensile Stiffness Orientation of the paper or paper board.
DEFINITION :
The speed of an ultrasonic pulse in the plane of the paper depends on the elastic properties of the paper- Its tensile stiffness index (TSI). TSI can be compared withyoung's modulus (or the "E" modulus) for other materials. The relationship can be expressed as:
TSI= v^2*C, Tensile Stiffness (St)= w* v^2*C
Where TSI = Tensile stiffness Index (KNm/g or MNm/Kg) of the paper measured using the Ultrasonic method.
V = Propogation velocity (Km/Sec) of the ultrasonic pulse
C = A dimension less constant close to 1 depending on poisson's ratio for the paper.
w= grammage kg/m^2

TESTING EQUIPMENT :
L&W TSO Tester



TSI MD	8.28
TSI CD	4.19
TSI MD/CD	I.98
TSI Min	4.12
TSI Max	8.35
TS I Max/Min	2.03



PHYSICAL PROPERTIES

Twist & curl

METHOD REFERENCE: QS/TM/72

STANDARD REFERENCE: Internal method

SIGNIFICANCE:
To quantify the curling tendency of Paperboards after subjecting to different RH conditions. Curling plays a major role for smooth speed runnability of blanks on automated packing lines.

TESTING EQUIPMENT:
L&W Twist Curl Tester

CHEMICAL PROPERTIES

Moisture Content

- Significance
  - Moisture is significant for economic reasons and for its effect on such properties as printability, shrinkage, dimensional stability, physical strength, and paper runnability.
- Standard Test procedure references
  - TAPPI T 412
  - ASTM D 644
  - ISO287
  - SCANP4
  - IS 1060Part5/Sec2
- Equipment
  - Oven
  - Digital Balance
- Unit of Measurement
  - %

CHEMICAL PROPERTIES

DETERMINATION OF EDGE WICKING INDEX – LA/23 FOR AESTHETIC PACKAGING

solution absorbed through the edges of test pieces under specified testing condition.

Water Absorption (Edge wick)

SIGNIFICANCE: The edge wick index is set by the amount & type of Sizing agent retained in board. Low edge wick values .In lactic acid one of importance for Good product resistance.

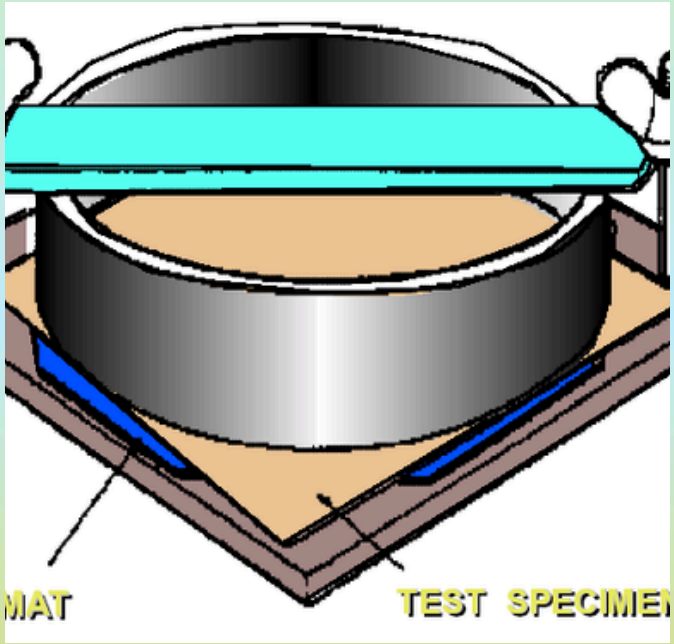
METHOD REFERENCE : QS/TM/22

STANDARD REFERENC : TP 84010

CHEMICAL PROPERTIES

Water Absorption (Cobb)

- Significance
  - Represents the absorption behavior of the board.
  - Significant
- Standard Test procedure references
  - TAPPI T 433
  - ASTM D 779
  - IS 1060 Part5/Sec4
- Equipment
  - Cobb Tester
- Unit of Measurement
  - g/m²



CHEMICAL PROPERTIES

Castor Oil Absorption

- Significance
- Measure the Absorbancy rate of paper for printing Ink having an oil vehicle.
- It is helpful for any paper where absorbancy of an oil-based vehicle in important
- Standard Test procedure references
  - TAPPI T 462
- Equipment
  - COA Tester
  - Timer
- Unit of Measurement
  - Seconds

CHEMICAL PROPERTIES

pH

- Significance
  - The pH deamination measures the extend to which the paper alters the Hydrogen-hydroxyl equilibrium of pure water.
  - The pH is important because of its effect on the permanence of the paper.
- Standard Test procedure references
  - TAPPI T-435
  - IS 1060 part-4/Sec-7
- Equipment
  - pH meter

STRENGTH PROPERTIES

- Bursting strength
- Tearing Resistance
- Tensile strength
- Z-Tensile
- Ring Crush
- Folding Endurance
- Plybond

STRENGTH PROPERTIES

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rength

- **Significance**
- Bursting strength is defined as the hydrostatic pressure in kilopascal or psi required to produce rapture of the material when the pressure is increased at a controlled constant rate through a rubber diaphragm to a circular area, 30.5 mm(1.20 in).
- It is also effected by variation in moisture content of sheet.
- Increase fiber length makes for a higher bursting strength, but bursting strength is even more effected by fiber bonding.
- **Equipment**
- Bursting strength tester

- **Test Methods:** Code 180 for paper ISO 2758, TAPPI T 403
- IS 1060 Part6/Sec2
- Code 181 for board: ISO 2759, TAPPI T 807, T 810

STRENGTH PROPERTIES

Tearing Resistance

SIGNIFICANCE:

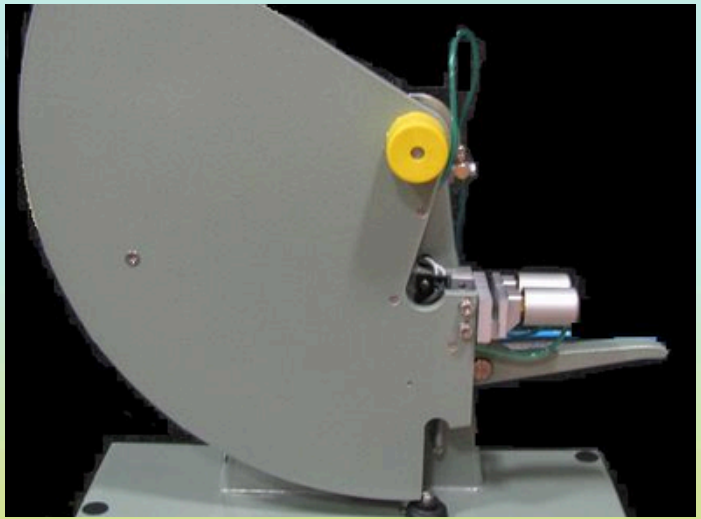
It is one of the important strength properties of the Paper and Paperboard. The value assesses the internal tearing resistance of the product.

METHOD REFERENCE : QS/TM/57

STANDARD REFERENCE : TAPPI T 414, IS 1060 PART6/SEC1

TESTING EQUIPMENT :

L&W Tearing strength tester (Elmendorf Type)



STRENGTH PROPERTIES

Tensile Strength

Significance

Tensile strength is an indication of extensibility and serviceability in many papers, such as web printing ,wrapping, bag and gummed tape and creped papers.

Test Methods

- TENSILE STRENGTH ISO Method: 1924-3,TAPPI T:494,IS 1060 Part5/Sec6
- Equipment Supplier: Lorentzen&Wettre

STRENGTH PROPERTIES

Z-Tensile

Significance:

This method describes a procedure for measuring the internal fiber bond strength (z-direction tensile strength) of paperboard using an instrument that subjects a normal separation force.

Test Method: ISO 1575, TAPPI T541, SCAN P 80:98

Supplier:
Lorentzen & Wettre,
Sweden

STRENGTH PROPERTIES

Ring Crush

SIGNIFICANCE :

Corrugated and solid fiber board containers are subjected to crushing forces in shipment.

This test is used for two purposes in the evaluation of paperboard to be used as component in such fiber board container.

1 To indicate edge wise rigidity of the board.

2 To indicate probable crushing resistance of the finished container.

STRENGTH PROPERTIES

Folding Endurance

SIGNIFICANCE:

Folding endurance test have been used to estimate the ability of paper to withstand repeated bending, folding, creasing.

Folding endurance also been useful for measuring the deterioration of paper upon aging.

STANDARD REFERENCE:TAPPI T423, IS1060PART6/SEC3

TESTING EQUIPMENT: L&W

STRENGTH PROPERTIES

Plybond

- Significance
  - Represents bonding between the layers
  - Significant for printing operations
- Standard Test procedure references
  - TAPPI T 833
- Equipment
  - Scott Plybond tester
- Unit of Measurement
  - J/m²

Optical Properties....

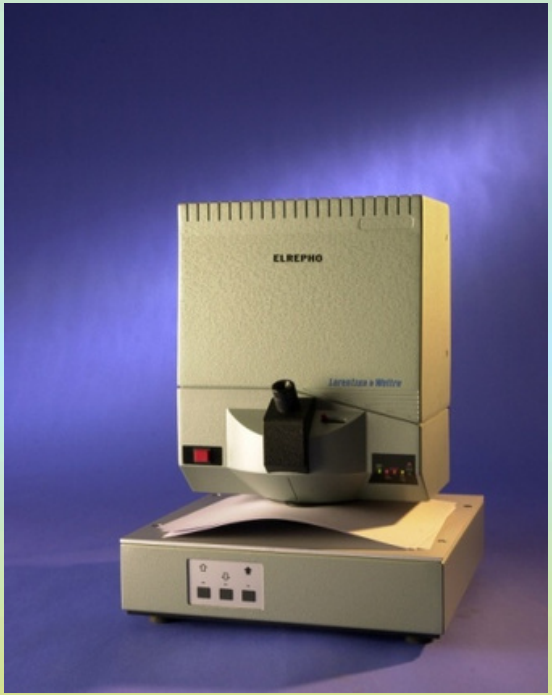
OPTICAL PROPERTIES

- Brightness
- Colour
- Whiteness
- Gloss

OPTICAL PROPERTIES

Brightness

- Significance
  - Represents the shade of the paperboard
  - Important in deciding the optical behavior of the board
- Standard Test procedure references
  - TAPPI T 560
  - ISO2469
  - Is 1060 Part4/Sec13
- Equipment
  - L&W Elrepho
  - Technidyne Color Touch
  - Spectrophotometers
- Unit of Measurement
  - %



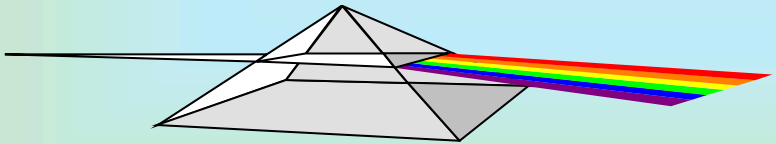
Optical Properties

Color Whiteness

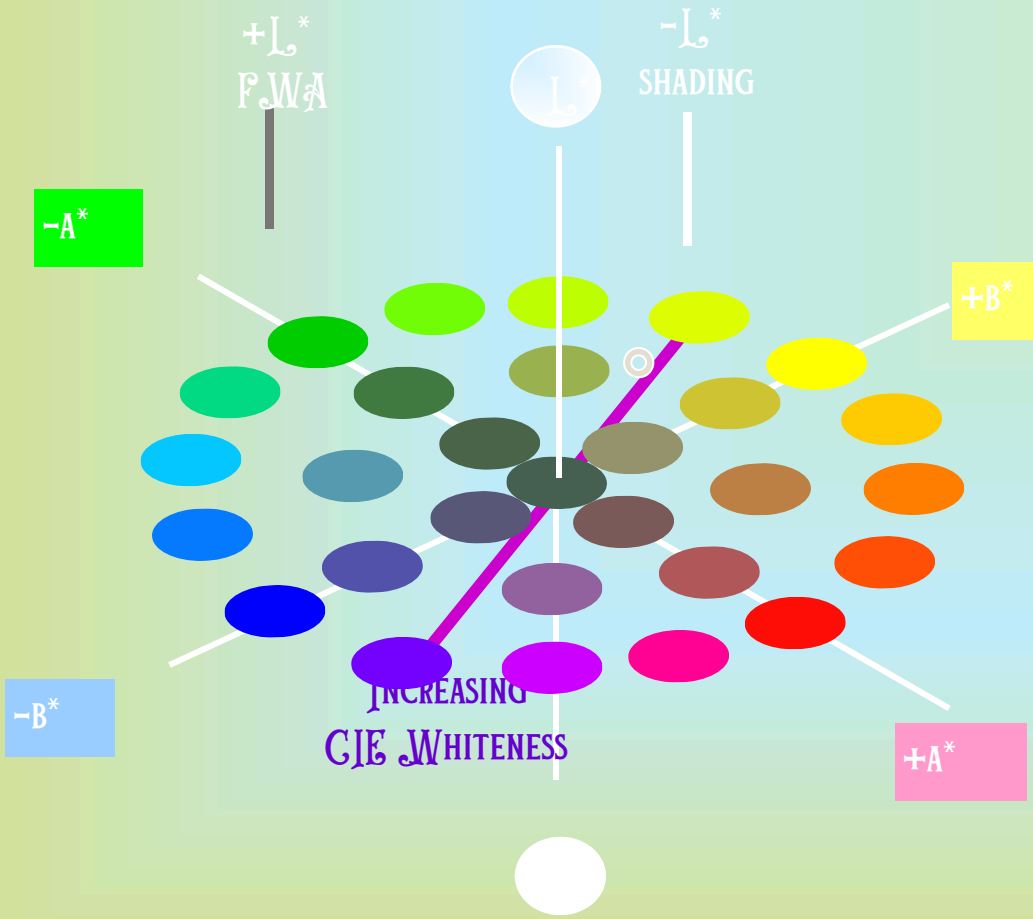
WHITE LIGHT

- White light consists of all colors i.e. all wavelengths in the visible spectrum 400-700 nm.

- Daylight is close to white and when it passes through the rainbow or a prisma, the different components in the light can be seen



COLOR



FWA:
L* increases lighter
a* increases redder
b* decreases bluer
D65/10° Brightness increases

Violet Shading Colorant:
L* decreases darker
a* increases redder
b* decreases bluer
D65/10° Brightness decreases

OPTICAL PROPERTIES

Gloss

METHOD REFERENCE:QS/TM/27

- STANDARD REFERENCE:TAPPI T 48
- IS 1060 Part5/Sec12
- MEASURING RANGE:0 – 100%

SIGNIFICANCE:
This method is widely used as a partial measure of the quality and shiny appearance of coated paper or paperboard.

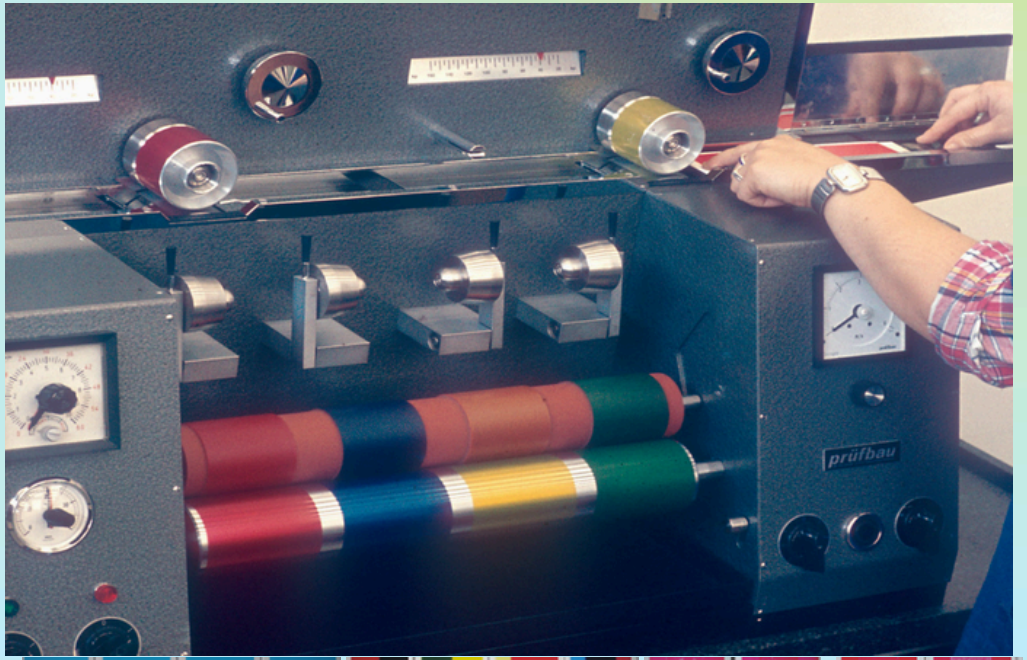
DEFINITION:It is the percentage of the light that is reflected from the surface at an angle equal to the angle of incidence in comparison with standard surface.

Some other Testing.....

PRINTABILITY ANALYSIS

Prufbau:

- Multi-Color Printability
- Set-Off
- Dry Pick
- Wet Pick
- Mottling
- Print Blister
- Aq Varnishing
- UV Varnishing



PRINTING PROPERTIES

Significance

Pick resistance & pick velocity are most important during printing to sustain the tackiness of the printing ink.

IGT

Standard Reference:

ISO 3783 & TAPPI 514

Method Reference :

QS/TM/31

Burn Out

SIGNIFICANCE

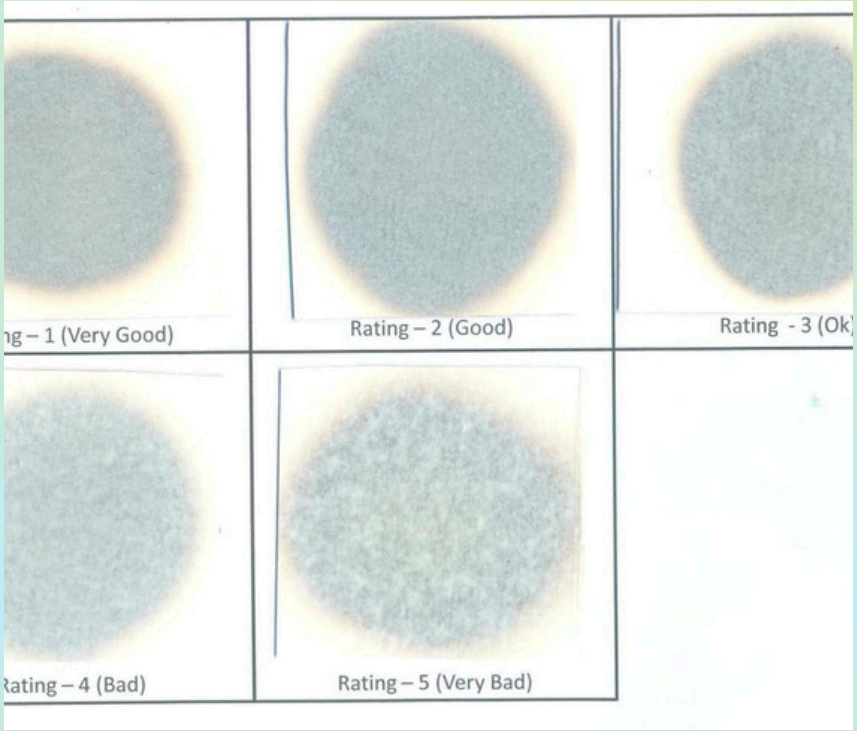
The Burnout signifies the uniformity of paper
coating coverage. Uniform Coating Coverage
is very important for achieving uniform printability

DEFINITION

Burnout Test also know as Coating coverage
test, is technique deployed for characterization
of coating paper surface

TESTING EQUIPMENT

Bunsen Burner (Temp-180°C)



RATING SCALE

GREASE RESISTANCE –KIT TEST

- This method describes a procedure for testing the degree of repellency and/or the ant wicking characteristics of paper or paperboard.
- Testing involves placing a series of numbered reagents (varying in surface tension and viscosity or “aggressiveness”) onto the surface of the sample. The solutions are numbered from 1 (the least aggressive) to 12 (the most aggressive).
- The highest numbered solution that does not stain the surface is reported as the kit rating.

- Standard Test procedure references-TAPPI T 559

IMAGE DENSITY OF THERMAL PAPER

- Image density testing for thermal paper involves evaluating how dark or light a printed image appears, usually quantified by optical density (OD)
- Image density in thermal paper refers to the concentration of the printed image on the paper,

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Thank you