

## An Approach to Standardizing Process Defects and Terminology

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### Extended Abstract

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#### **SUMMARY**

This presentation will discuss the problems created in the defect elimination process by the lack of a standard naming convention for web coating defects. To help eliminate this problem, a computer based reference, *AIMCAL Coating Defects Lexicon*, has been developed which provides standardized terminology for defects and the web coating, troubleshooting defect guides and extensive images of defects.

#### **INTRODUCTION**

The web coating and drying process produces a wide variety of defects, which are unacceptable to the customer, such as physical coating defects, drying defects, coating weight non-uniformities, winding defects etc. As a result prevention and elimination of defects is an ongoing need for all personnel in the converting industry in order to insure a quality product and economic success.

However, currently, there is no source of standard names or naming conventions for defects. The naming process is a function of the observer's impression of the defect, past history and the industry in which it seen. This results in the widespread use of jargon to describe the defect. Consequently, the same defect can have many different names and conversely many different defects can have the same name. Another factor in the use of jargon is that the defects have unique visual characteristics and they are hard to describe using conventional terminology. Similarly, process hardware components can have a variety of names.

This lack of standard naming convention leads to an inefficient troubleshooting process and can result in wasted effort. It also complicates communications between people working to eliminate the defect and makes it harder to find literature references and technology on the defect.

#### **APPROACH**

The approach selected to improve this problem was to develop a reference, which would contain standard terminology for the web coating process. As the scope of this reference was being developed, it became apparent that its function could be expanded to include a wide range of information, which would be helpful to the overall troubleshooting process, in addition to standard terminology. Since there is no standard naming conventions, the author's selected standard name based on their experience and the most widely used name. All of the Jargon

names were cross-referenced to the standard name. Due to the dynamic nature of this reference it can be modified as appropriate.

The reference, which resulted from this effort, is, the “AIMCAL Coating Defects Lexicon”. It is a computer based user-friendly reference which contain both text and images and provides:

- standardized names for coating, drying and metallizing process defects
- standardized definitions of web coating process terms and components
- defect classification system
- description of defects including multiple images of specific defects
- information as to defect causes and how to cure them
- listing of defect Jargon names with reference to standard name
- search routines to help user locate specific information
- the ability for additional input to be easily added.

The Lexicon is available as a network based program that can be loaded on to a server. This format was chosen because it provides the ability to provide high quality images at a reasonable cost, can be readily upgraded and user search capability is easy and powerful. The various sections and functions are accessed through the home page. A paper based version would take longer to prepare, would require high quality expensive printing to maintain image quality and would not be dynamic.

The Lexicon consists of four main sections, which are described, in detail in the next sections:

- a glossary that contains standardized definitions of coating defects, representative images of these defects, and definitions of coating process terms.
- a troubleshooting guide that contains the defect standard name, defect images, alternate defect names, defect cause and actions to eliminate them.
- an image section that contains only defect images.
- a search system to locate specific defects and definitions

## **DEFECT CLASSIFICATION**

In order to simplify the locating and presenting of the appropriate information, each of the defects in the Troubleshooting Guide and Defect Image Section is classified according to the basic physical characteristics of the defect, such as shape, direction, and location. The search routine can be used to search for defects with specific characteristics, such as spots, machine direction, continuous defects, contamination defects, drying and substrate etc.

## **LEXICON SECTIONS**

### **GLOSSARY**

The glossary section contains definitions of coating defects web coating process terms and images where appropriate. Definitions included are coating and substrate defects, coating applicators, process hardware, rheological and performance properties. Substrate definitions are also concluded along with metallizing process terms. A standard defect name has been selected

where there are multiple defects names. The Jargon names are also included and referred to the standard definitions. The defects are classified using the classification scheme.

The images contained in the definitions are thumbnails, which can be expanded to full screen for detailed viewing. There is also a link to the defect record, which has more detailed information about the defect. Typical glossary entries are in Figure 1-2.

## **DEFECT RECORD**

The defect record provides detailed information on coating process defects. This section is designed to permit the user to correctly identify a defect that they are working with and to obtain information to help eliminate the defect. In those cases where defects have multiple names, the author selected the name with the most common usage as the standard name. Alternate names are also listed.

Each defect has a separate record, which contains the following defect information:

- standard name
- alternate names,
- description
- cause
- actions to eliminate.
- several representative images of the defect.

The entries are also classified according to the classification scheme 1 to assist in searching this section.

Figure 3 is an example of a typical defect record for the common defect of ribbing.

## **DEFECT IMAGE SECTION**

This section contains only the images in the database. It is intended to help the user identify a new defect and determine the standard name by scanning the section and comparing their defect with the images in this section. Another advantage is that more defect images are displayed in this section, whereas the previous sections had only selected images. The images are classified according to the classification scheme discussed in Figure 1, so that the user can readily locate defects with similar characteristics to the new defect.

## **SEARCH CAPABILITY**

There are several different methods that can be used to retrieve information from the Lexicon. The glossary section is alphabetized and can be browsed. It can also be searched using key words. The troubleshooting guide is indexed for ease in searching and it can also be searched by either keywords or for specific classes of defects. The image section is arranged by the defect classification system and can also be searched by using key words.

## FUTURE ADDITIONS

Additions and modifications to the Lexicon will be done on an ongoing basis.

## AVAILABILITY

For Information on obtaining the Lexicon see AIMCAL website [www.AIMCAL.org](http://www.AIMCAL.org).

Figure 1  
Glossary entry

The screenshot shows a web page titled "The AIMCAL Defects Lexicon" with a "GLOSSARY" tab. A navigation bar contains letters A through Z. The main content area displays three entries:

- BUBBLES:** A small globule of gas trapped in a coating solution or dried film. Classifications: || Process Specific: Coating, ||
- BUBBLES (MICRO):** Small bubbles that are less than 30 microns in diameter usually resulting in a loss of glossy appearance. Microbubbles can be determined only by microscopic examination. Classifications: || Discrete Point: Spots, ||
- BUBBLES SPOTS:** Bubbles are clear round spots with little or no coating in the final coated film. They can vary in size depending on the size from 50 to 1200 microns. The key characteristics are that they are round and have clear centers. They can be randomly distributed across the web. The bubbles may break, giving a cratered appearance in the dried product. Air entrapment may occur during solution flow to the applicator or as a result of outgassing during drying. A link to an associated defect record is provided: [Bubble Spots](#). Classifications: || Discrete Point: Spots, || || Process Specific: Coating, Drying, ||

Small images are shown next to the "BUBBLES SPOTS" and "BUBBLES SUBSTRATE" entries. The "BUBBLES SPOTS" image shows a dark circular spot on a light background, and the "BUBBLES SUBSTRATE" image shows a textured surface with small dark spots.

Figure 2  
Glossary Entry

GLOSSARY

The AIMCAL Defects Lexicon

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Classifications:

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**APPLICATOR ROLL:** The roll in a roll coating process, which applies and meters the coating solution.

Classifications:

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**APPLICATOR ROLL SPOTS:** Defined as areas of varying dimension that are devoid of coating but do not have heavy coating area around spots as in [Backing Roll Spots](#). These are seen only on coaters with roll applicators. Foreign material on the applicator roll causes momentary reduction of clearance between applicator roll and web surface which results in less color transfer to web. Heavy color outline does not show up around the spot because doctoring characteristics of the blade are not affected as in Backing Roll Spots. Applicator Roll Spots are readily visible with transmitted light or ultraviolet light. See also [Streaks](#), [Ribbing](#), [Comb Lines](#)

Link to Associated Defect Record:

[Applicator Roll Spots](#)

APPLICATOR ROLL SPOTS

Classifications:

|| Discrete Point: Spots, Other Types ||

|| Process Specific: Coating, ||

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**APPLICATOR ROLL STREAKS:** Defined as a series of very narrow, parallel streaks about 6-13mm (0.25 - 0.5") apart. They do not appear to wander from side to side as do Railroad Track or Foam Streaks. Submerged roll zero-angle blade coaters are most susceptible to this defect. These streaks are best seen when viewed at low angle in machine direction (MD). See [Streaks](#), [Web Streaks](#)

Link to Associated Defect Record:

[Applicator Roll Streaks](#)

APPLICATOR ROLL STREAKS

Classifications:

|| Linear Continuous: Machine Direction, ||

|| Process Specific: Coating, ||

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**ARC RESISTANCE:** A measure of an electrical insulating material's resistance to a breakthrough by an electric current.

Classifications:

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**CHATTER, MECHANICAL:** Chatter is a series of bars in the transverse direction, which run across the width of the web. The bars are uniform and have a repetitive frequency. In mechanical chatter the bars are straight and perpendicular to the edge of the web. There is a slight difference in coating weight which causes the bar appearance.

Link to Associated Defect Record:

[Mechanical Chatter](#)

CHATTER, MECHANICAL

Classifications:

|| Linear Continuous: Transverse Direction, ||

|| Process Specific: Coating, ||

Figure 2  
Defect Record, Ribbing

DEFECT RECORDS

The AIMCAL Defects Lexicon

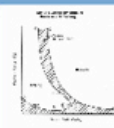
-
X

- Film Split Pattern
- Foam Streaks
- Gel Slugs
- Gravure Bands
- Grooved Roll Marks
- Haze External
- Haze Internal
- Mechanical Chatter
- Metal Fracture
- Missed Coating
- Mottle Printing
- Orange Peel
- Pick-off
- Pucker Wrinkle
- Railroad Tracking
- Repeat Spots
- Repellant Spots
- Reticulation
- Ribbing**
- Rivulets
- Road Tracks
- Metallized Substrate
- Scratches
- Serpentine Chatter
- Skinning
- Slime Spots
- Sludge Buildup
- Starry Night
- Static Marks
- Streaks (slot die, curtain, slide applicators)
- Substrate Flakes
- Surface Marks
- Wet Streaks
- Whiskering

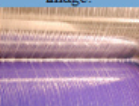
**Defect Record: Ribbing**

GRAPHICS:
| FIRST | <- PREVIOUS | 60 of 74 | NEXT -> | LAST |


Graphics for this defect:



**THUMBNAIL**  
Click on thumbnail to view full size image.



**THUMBNAIL**  
Click on thumbnail to view full size image.



**THUMBNAIL**  
Click on thumbnail to view full size image.

DEFECT DETAIL	
Standard Name:	Ribbing
Other Names:	Barring, Comb lines, Corduroy, Phonographing, Rake lines,
Defect Class:	linear continuous md , process specific coating
Defect Description & Attributes:	The ribbing defect is a series of lines running down the web. They are uniformly spaced and are across the entire web. They give the appearance that a mechanical device such as a comb or rake and has been drawn through the coating.
Defect Cause:	The ribbing defect is a result of hydrodynamic flow instability in the coating bead, which causes a sinusoidal variation of the coating weight in the transverse direction of the web. This leads to the stripes or ribs, which run in the machine direction. If the stripes do not level in the dryer then the defect will result. They can occur in almost every type of application. They may appear to be caused by a physical factor such as the wire spacing in a Mayer Rod coater but that is not the cause. The ribs would be present even with smooth roll. A pressure difference across the web causes the coating weight variation and is influenced by the viscous, inertial and surface tension forces across the bead.
Action to Eliminate:	The basic actions to eliminate ribs are to use a thicker coating weight and lower viscosity solution. In addition optimizing applicator and solution variables will eliminate ribbing. The coatability window for a specific application method and then adjusting conditions to be in defect free region is effective. A coatability window diagram for a reverse roll coating process is below.

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