Seminario Internacional Tissue

8 e 9 de agosto de 2005 / São Paulo - SP

" New Tools for Creping Process Control"

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PATROCÍNIO:

APOIO:

CURRICULUM PALESTRANTE

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Cargo: Suporte Técnico para Tissue em Latinoamerica

- Engenheiro Químico – com enfase em Papel – Univalle (Colômbia)
- 11 anos de Experiência com a Nalco em Latinoamerica e Estados Unidos no mercado Tissue
- Participação em cursos e seminarios internacionais de tissue

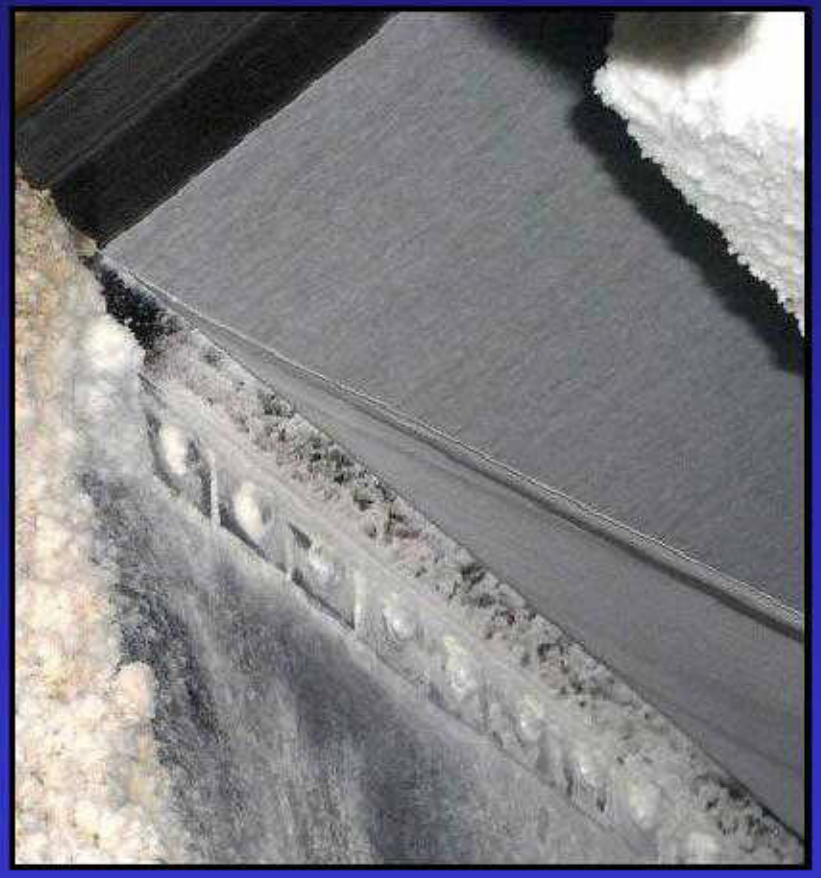
New Tools for Creping Process Control Agenda

- Coating Space
  A 3D View of Yankee Dryer Coatings
- Effects of Modifying Agents on Adhesive Film Properties
- Embedded Sheet Structures
  Impact On Tissue Properties

Coating Space

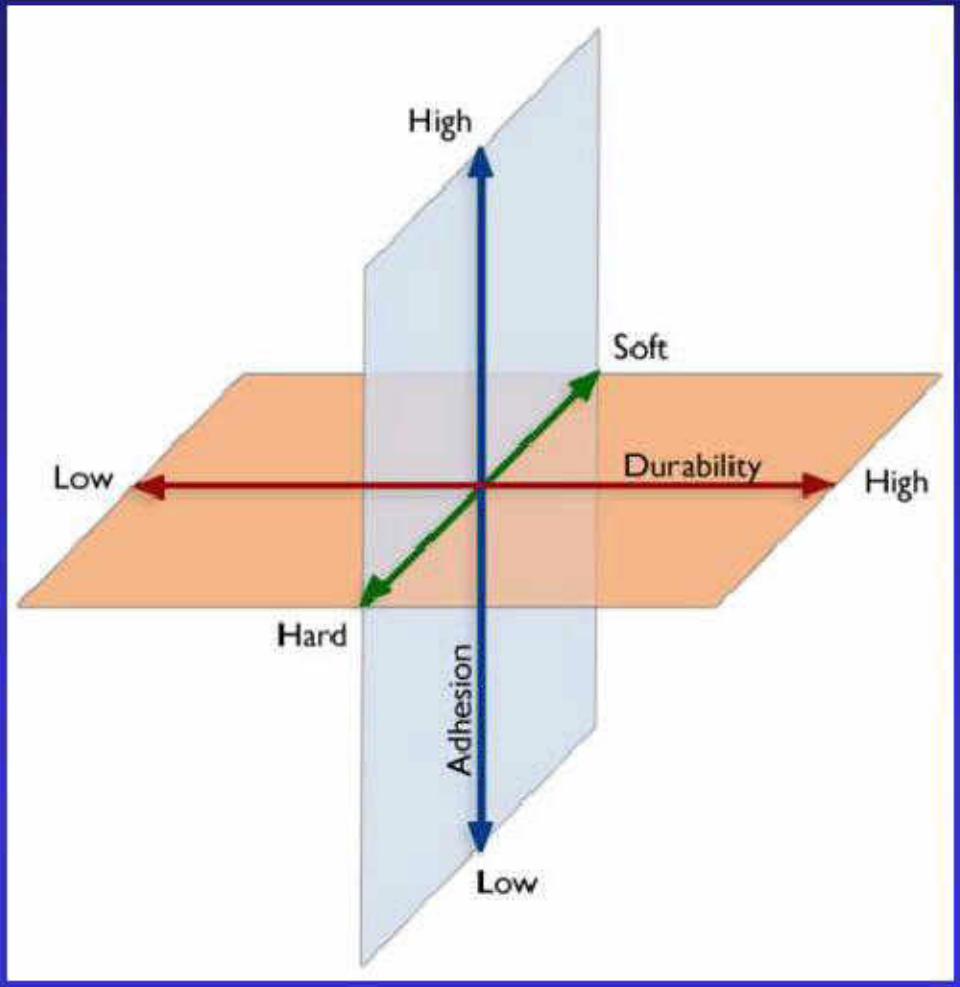
A 3D View of Yankee Dryer Coatings

BACKGROUND



- Industry Trends
  - Improved properties (softness)
  - Low moisture creping
  - TAD
- Coating Needs
  - Improved uniformity
  - Increased stability
  - Higher adhesion
  - Softer

COATING SPACE
A 3 D VIEW OF YANKEE COATINGS



ADHESION

Adhesion – Adhesion is the degree to which the tissue is attached to the creping cylinder.

There are two locations on the creping cylinder where adequate adhesion levels are critical: SPR and Creping Blade

SOFTNESS

Coating Softness – Softness is a term related to the viscoelastic properties of the coating. A softer coating has a lower modulus, is more flexible and is less brittle.

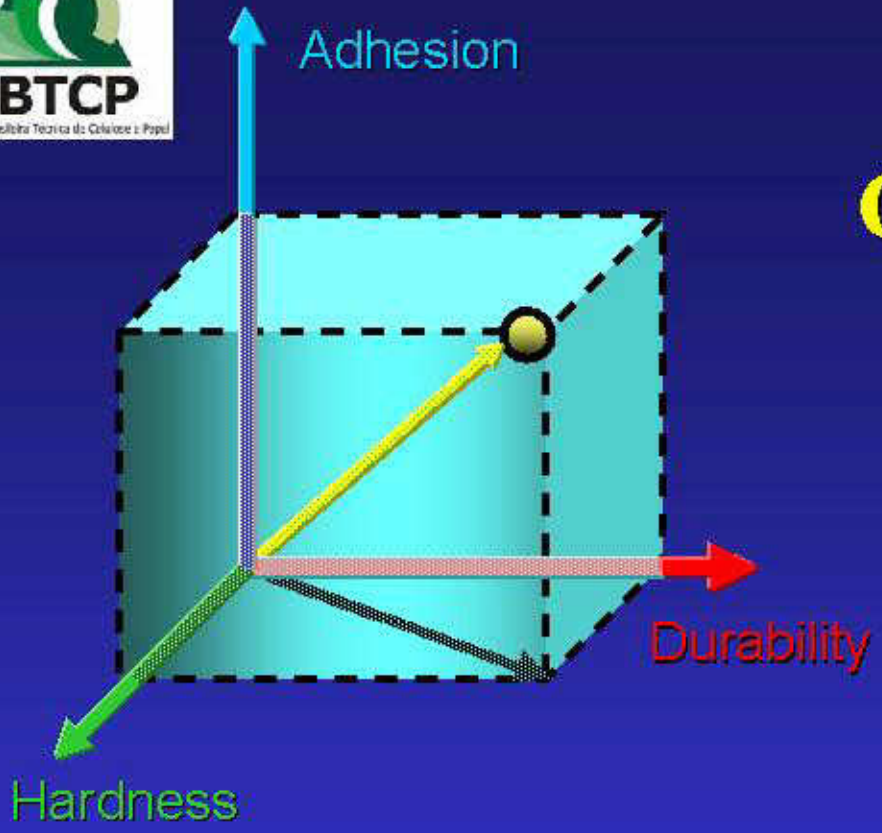
A soft coating re-wets more easily than a hard coating.

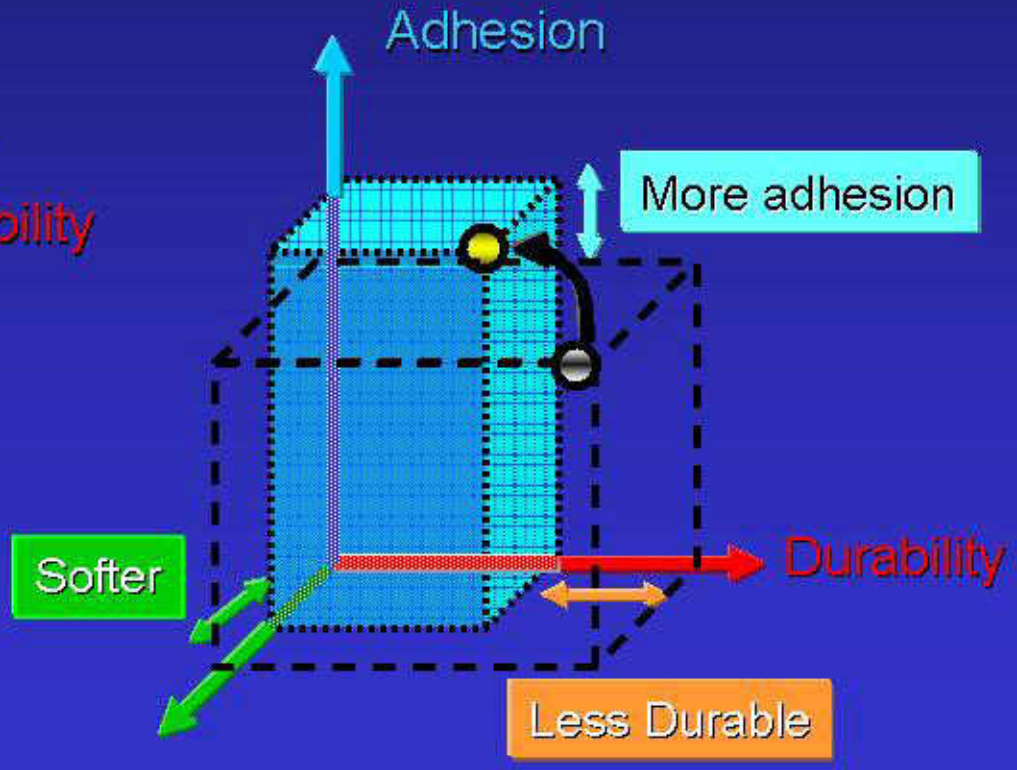
DURABILITY

Durability – This coating property is normally localized to the SPR nip. A durable coating has sufficient integrity to resist the dynamic hydraulic pressure and movement at the SPR, yet still facilitates sheet transfer and avoids felt filling.

If the coating is too moisture sensitive (not durable enough), it is probable that the coating will be washed off the creping cylinder surface

COATING SPACE





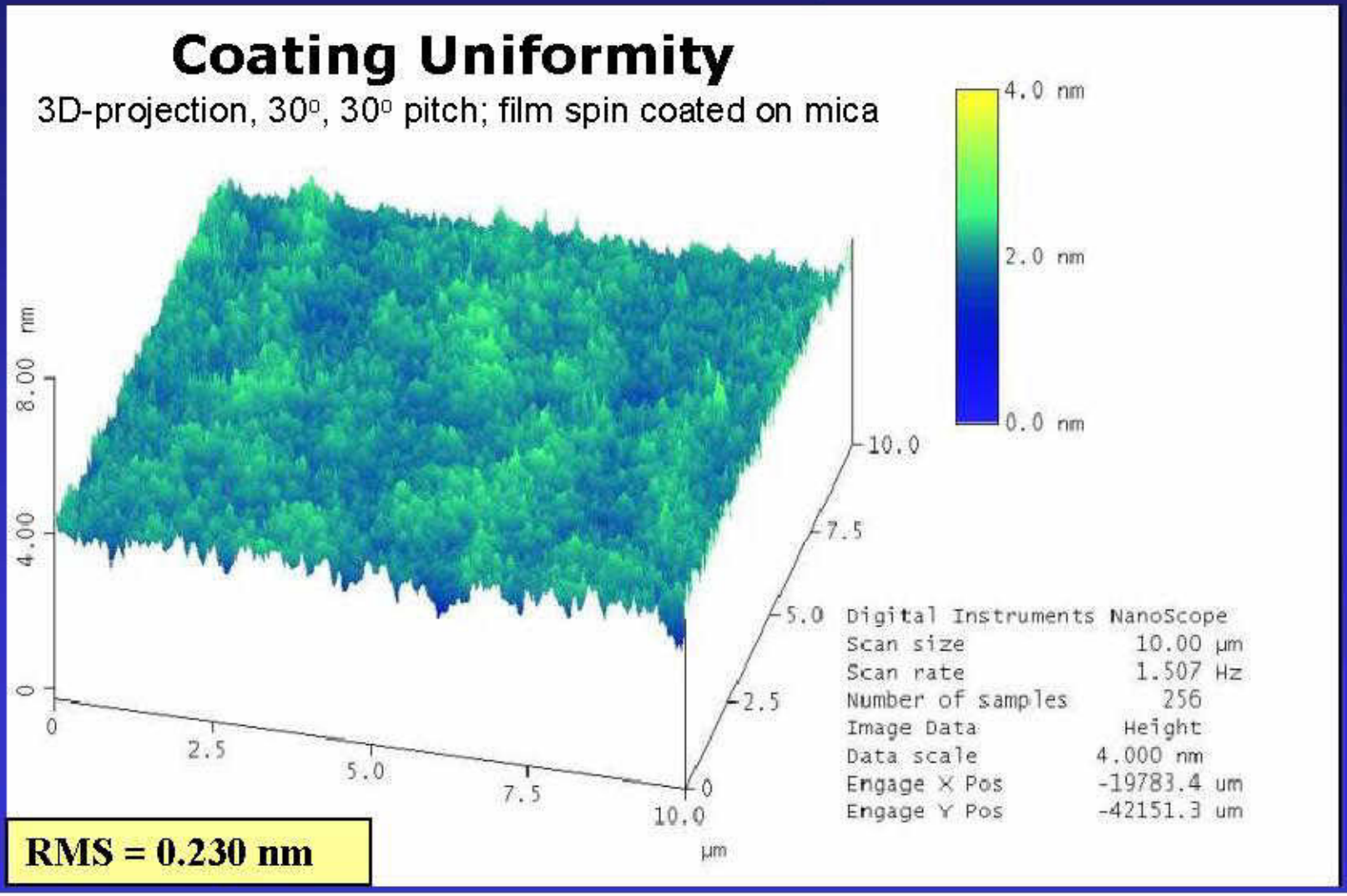
Effects of Modifying Agents on Adhesive Film Properties

YANKEE COATING MODIFIERS

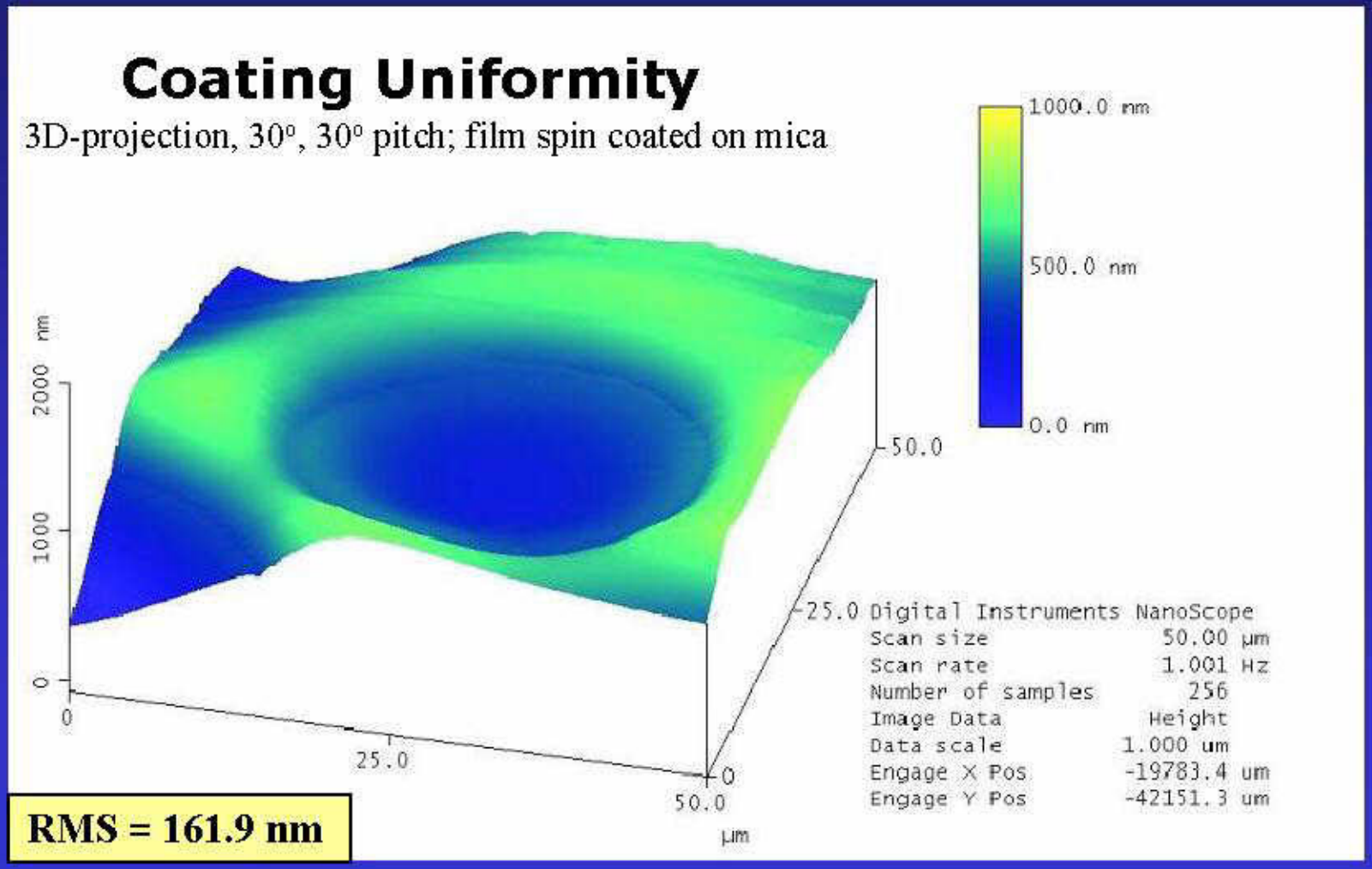
- Functions
  - Modify coating physical properties
  - Improve coating uniformity
  - Provide required release
- Types
  - Surfactants
  - Inorganics
  - Humectants

Sample ID	Description
M-1	Cationic surfactant blend
M-2	Nonionic surfactant
M-3	Humectant 1
M-4	Inorganic phosphate
M-5	Humectant 2
RO	Release oil – hydrocarbon oil + emulsifying surfactant

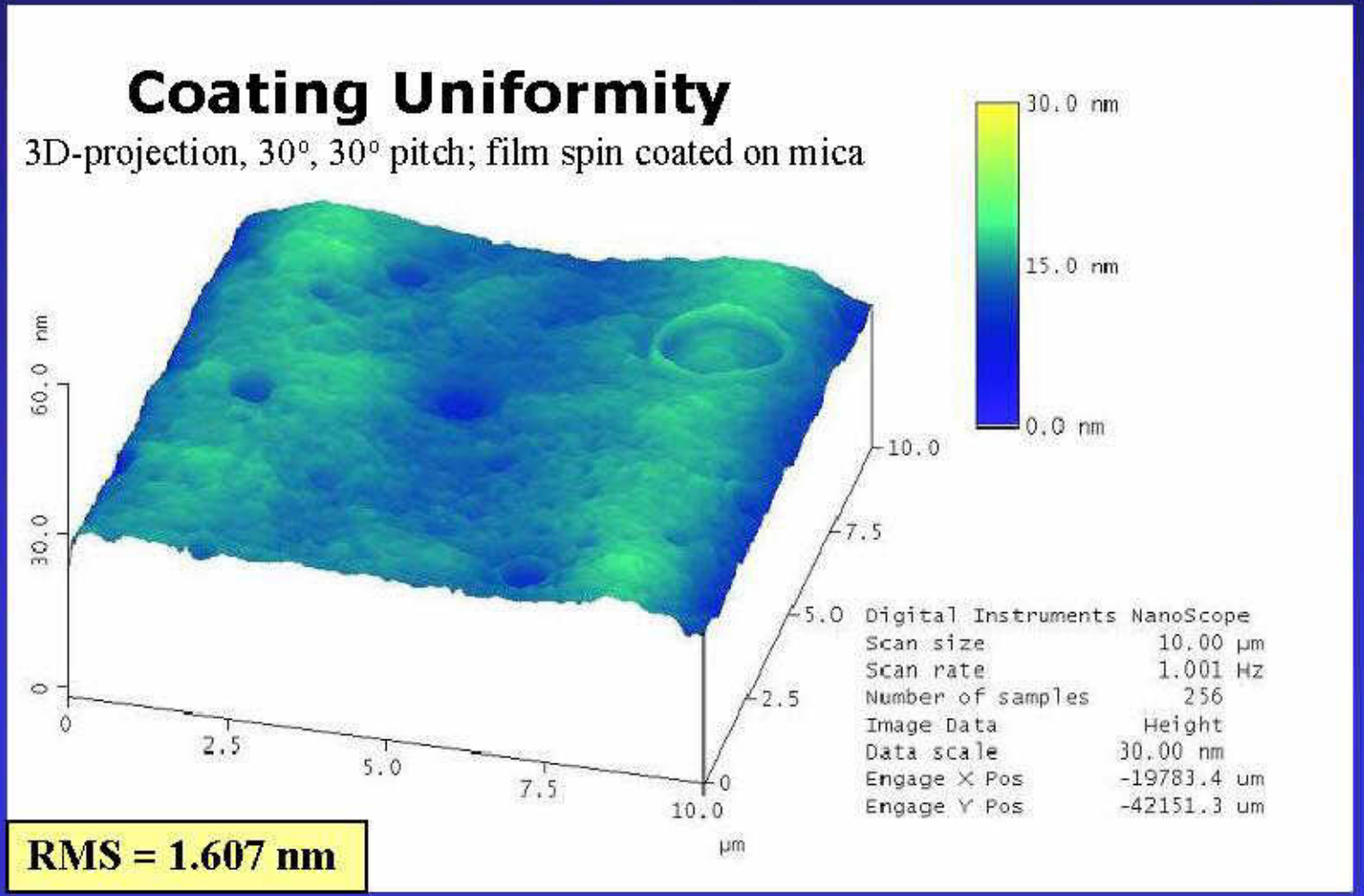
AFM HEIGHT IMAGE OF YANKEE ADHESIVE, PAE-1



AFM HEIGHT IMAGE MIXTURE OF PAE-1, RO (1:1, actives based)

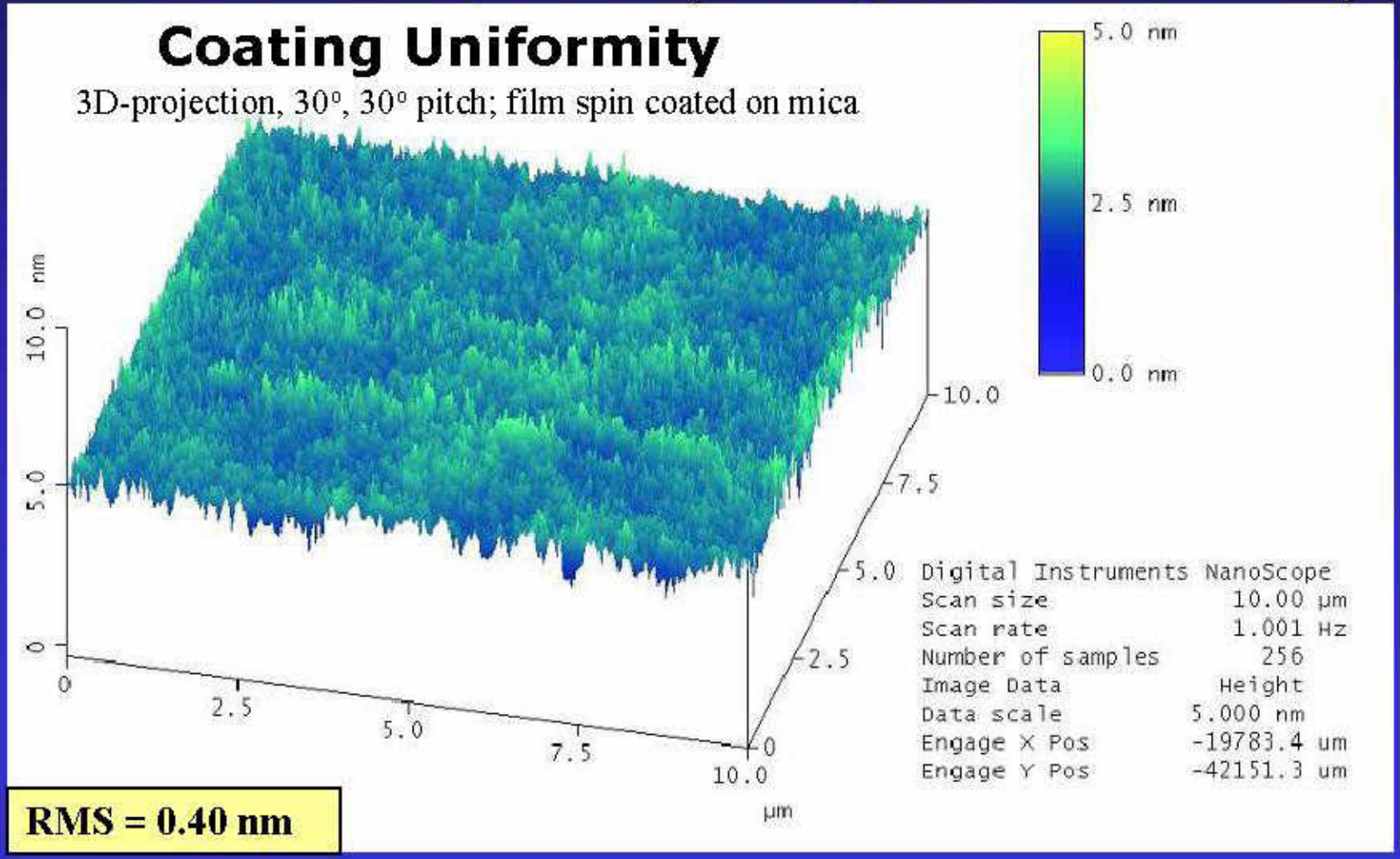


AFM HEIGHT IMAGE MIXTURE OF PAE-1, M-1 (5%, actives based)

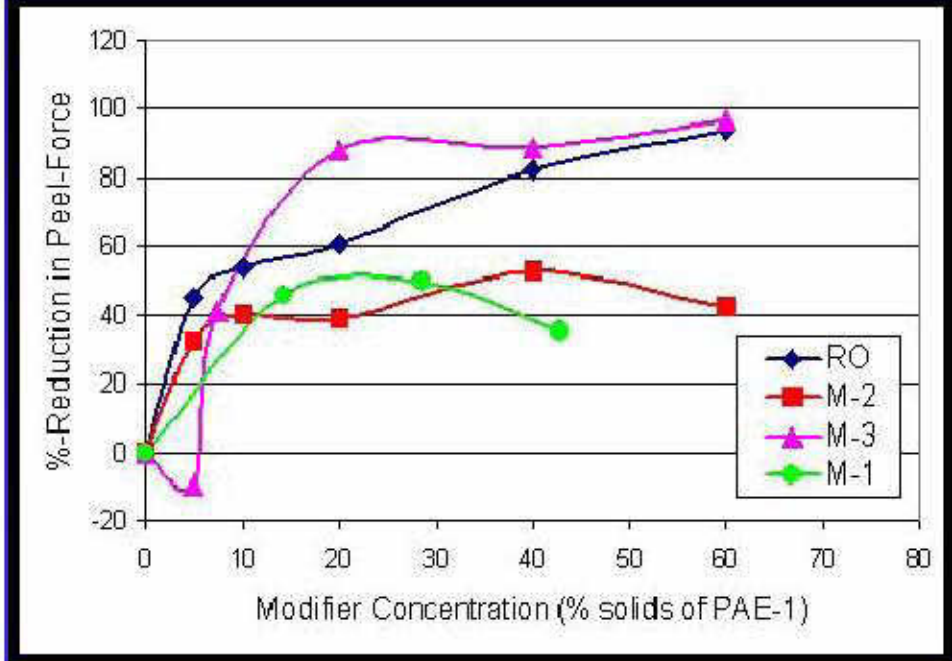


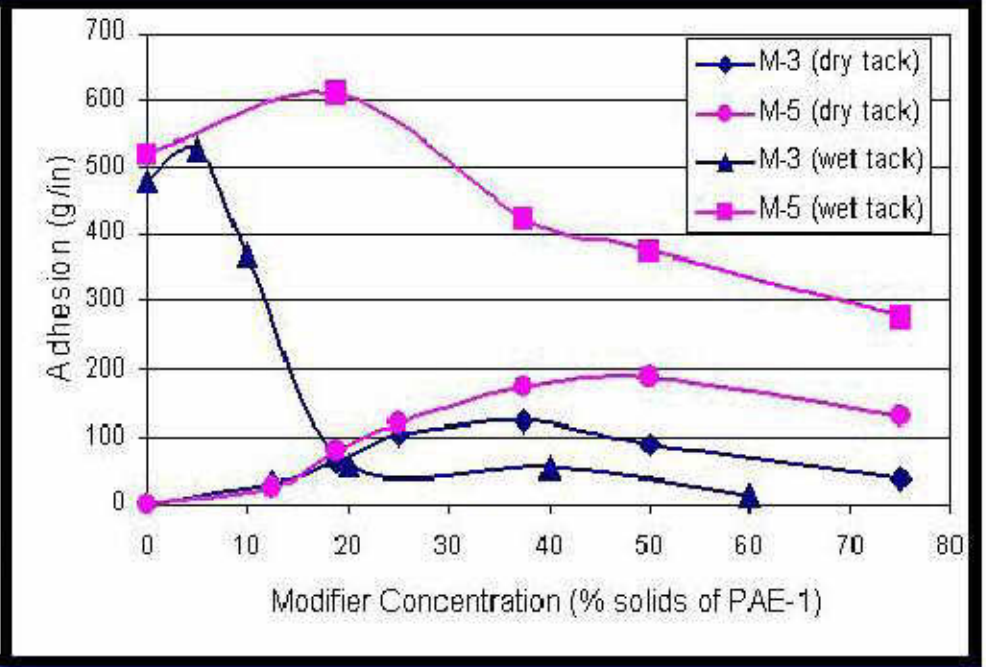
RMS = 1.607 nm

AFM HEIGHT IMAGE MIXTURE OF PAE-1, M-3 (20%, actives based)



PEEL FORCE STUDIES
COATING ADHESION





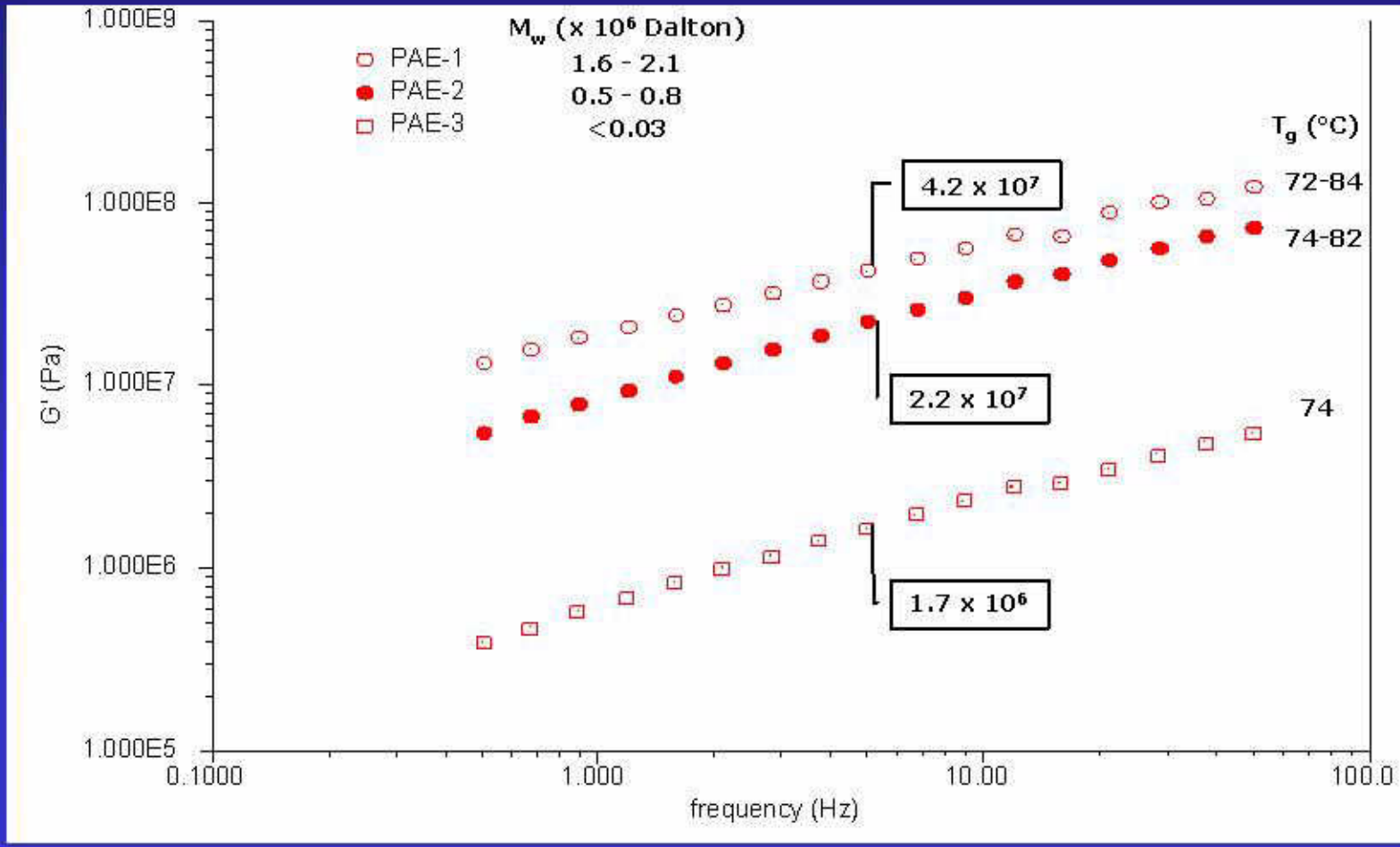
Wet tack results for various additives

Wet and dry tack results for humectants

EFFECT OF MOLECULAR WEIGHT ON SHEAT STORAGE MODULUS OF PAE POLYMERS

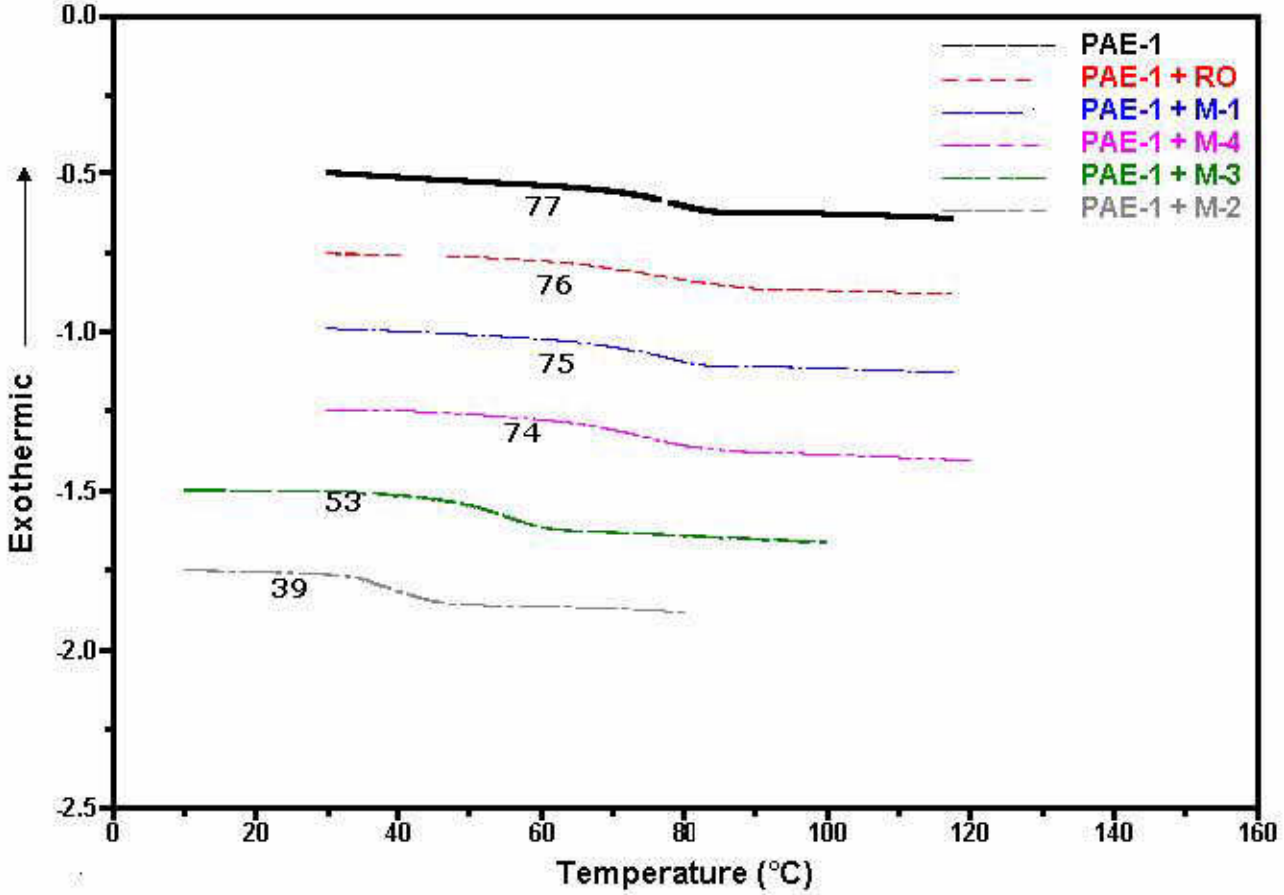
Coating

Softness



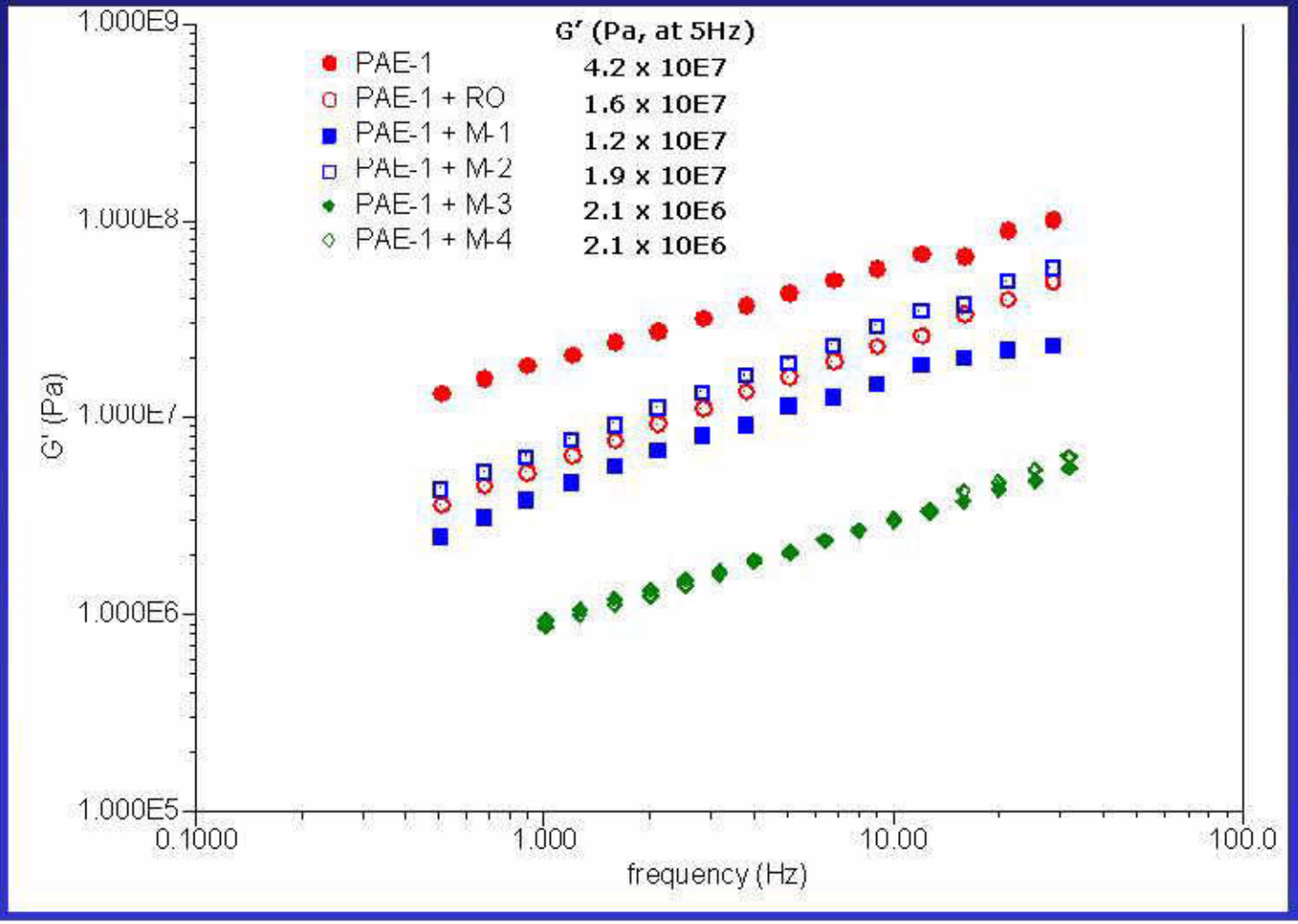
EFFECT OF ADDITIVES ON THE Tg OF PAE-1 POLYMER

Coating Softness



EFFECT OF ADDITIVES ON SHEAR STORAGE MODULUS, G', OF PAE-1

Coating Softness



CASE STUDY

Mill Overview

	Conditions	
	Old	New
Machine	5000 fpm TWF	same
Product	Bath Tissue	same
Creping Moisture	4.5%	2.5%
Coating Program	PAE/RO	PAE/M-3

Analysis of Business Situation

Key Drivers

- Bulk
- Handfeel

Challenge/Opportunity

- Improve tissue quality while maintaining productivity

Results

- ↑ Bulk
- ↑ Stretch
- ↑ Handfeel
- ↑ Productivity

CONCLUSIONS

- Modifiers can effectively alter adhesive and material properties of Yankee coatings.
  - Uniformity
  - Adhesion
  - Softness
- A variety of tests are needed in characterizing a coating system and in helping to predict performance.

Embedded Sheet Structures Impact On Tissue Properties

BACKGROUND

- Everyday the challenge of the tissue maker is produce quality Tissue products that meet and/or exceed the desires of the customer and end user.
- Softness is of prime concern to a large portion of the tissue produced for the tissue market.
- Creping is a key transformation that creates many of the properties desired by the customer.
- For creping to be optimized all unit operations ahead of this transformation must be optimized.

FORMATION

- Formation of the sheet has a major impact on the final sheet properties that can be developed at the creping transformation.
- Embedded structures within the sheet due to wire design and operation of the wet end can lead to improved sheet properties.
- Understanding (utilizing FFT technologies) can lead to processes that will deliver improved and predicted sheet properties.

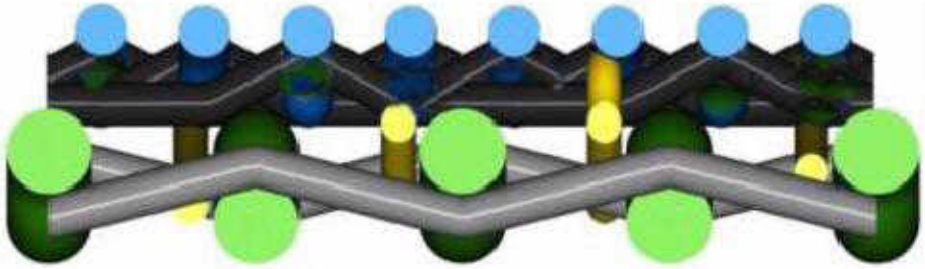
DISCUSSION TOPICS

- Wire design and embedded structures
- Impact of embedded structures on the creping process
- Explanation of the FFT technology
- Case Study

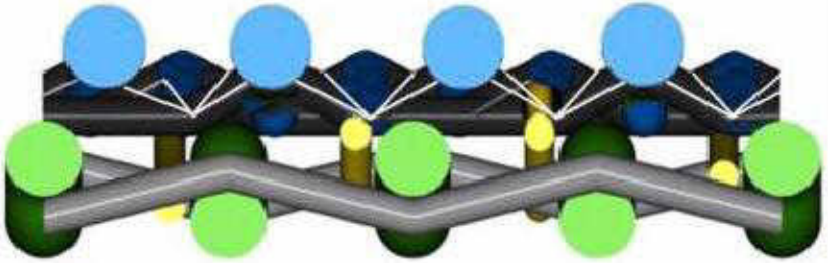
FORMATION AND WIRE DESIGN

Dimensionally Uniform

Embedded Structures



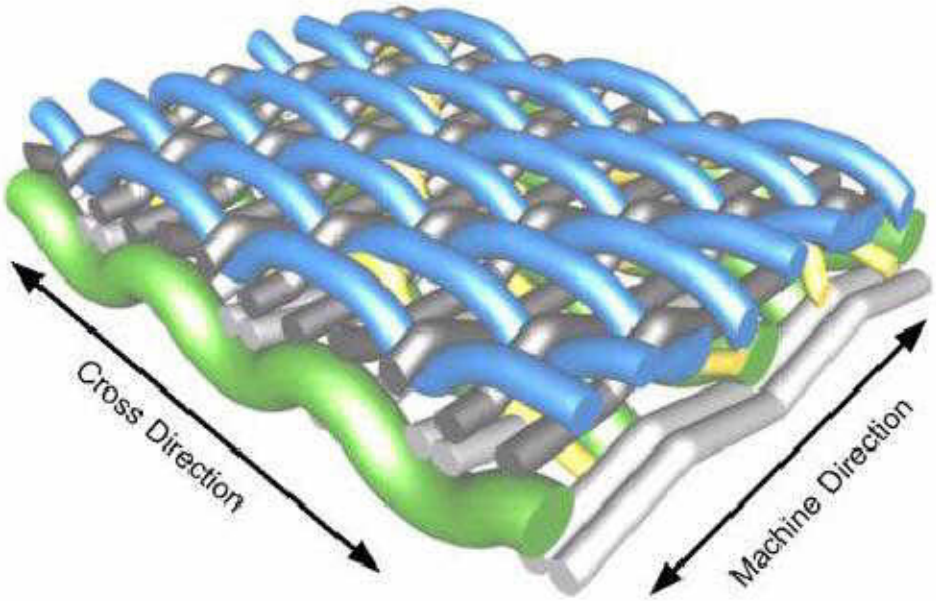
High Forming Surface Fiber Support

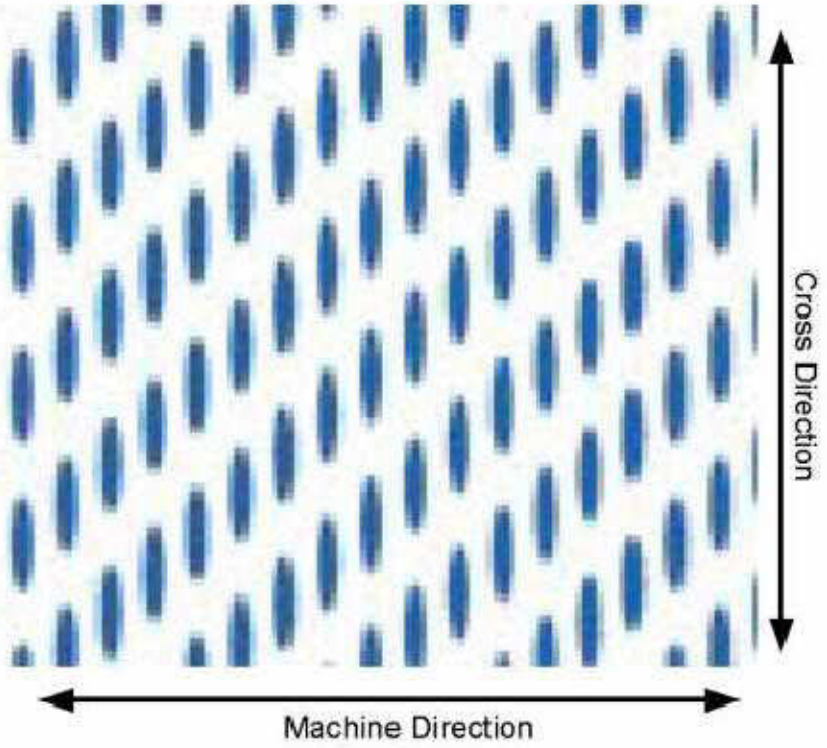


Significant Surface Topography

Machine Direction

FORMATION AND WIRE DESIGN





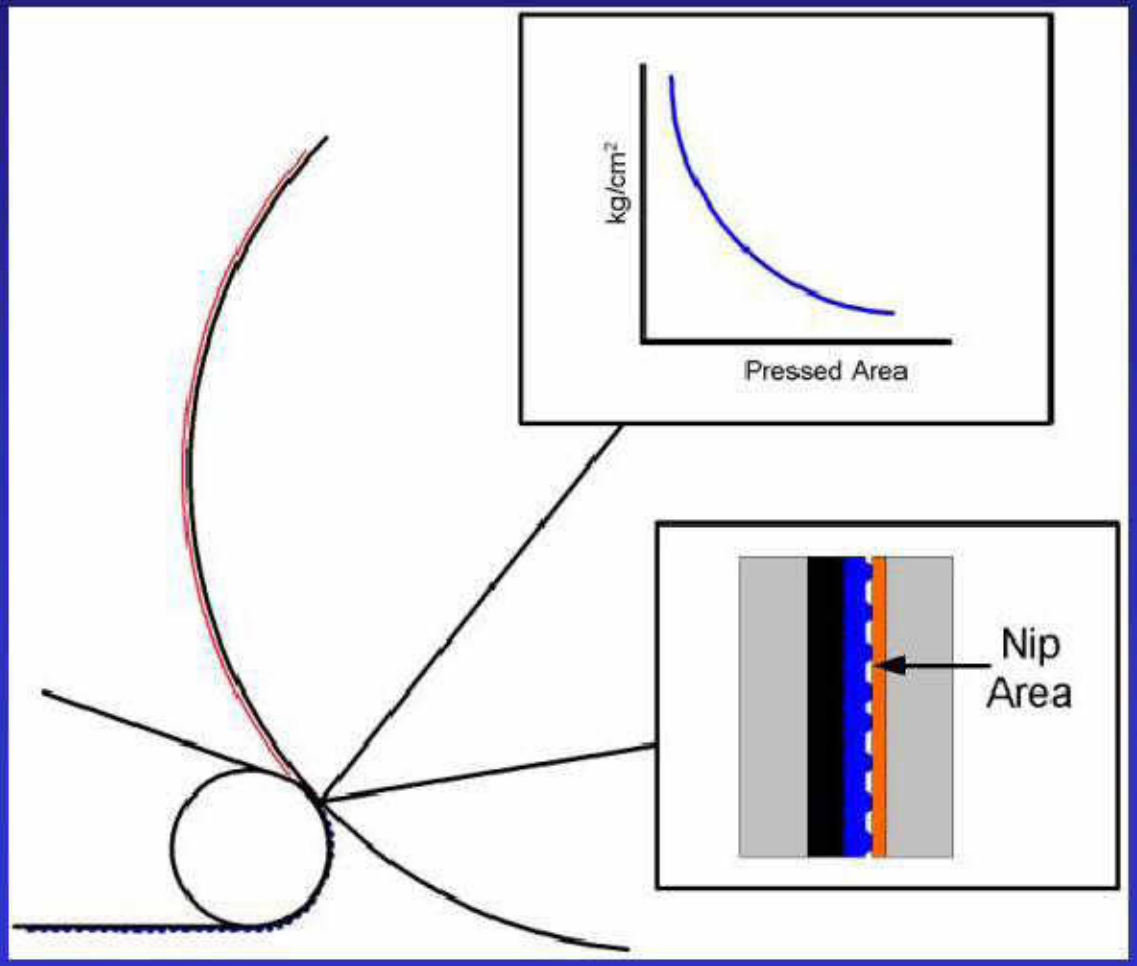
Euler's Equation

$$P_{cr} = \frac{\pi^2 E T^3}{L^2}$$

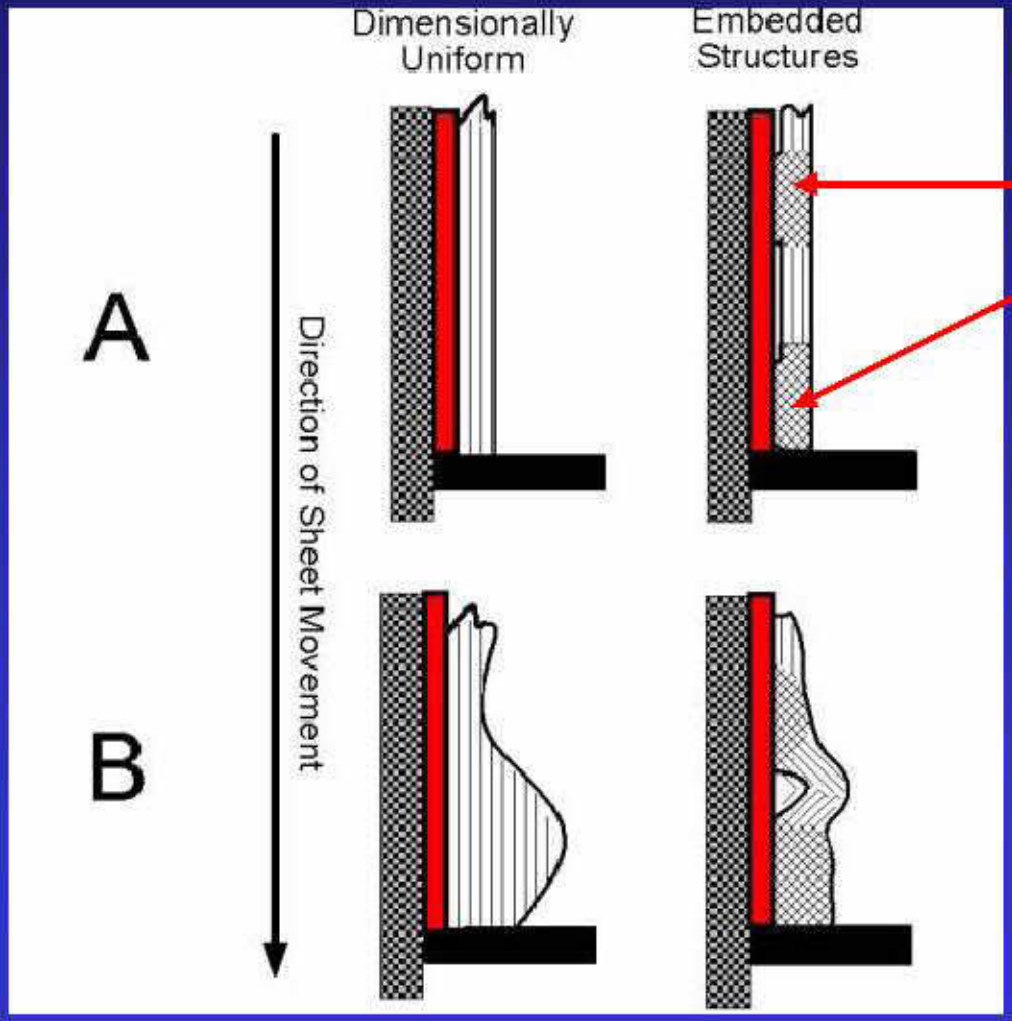
Where:

P_{cr} = Critical force for beam failure
E = Modulus of the material
W = Width of the beam
T = Thickness of the beam
L = Length of the beam

FORMATION AND LAMINATION TO THE YANKEE

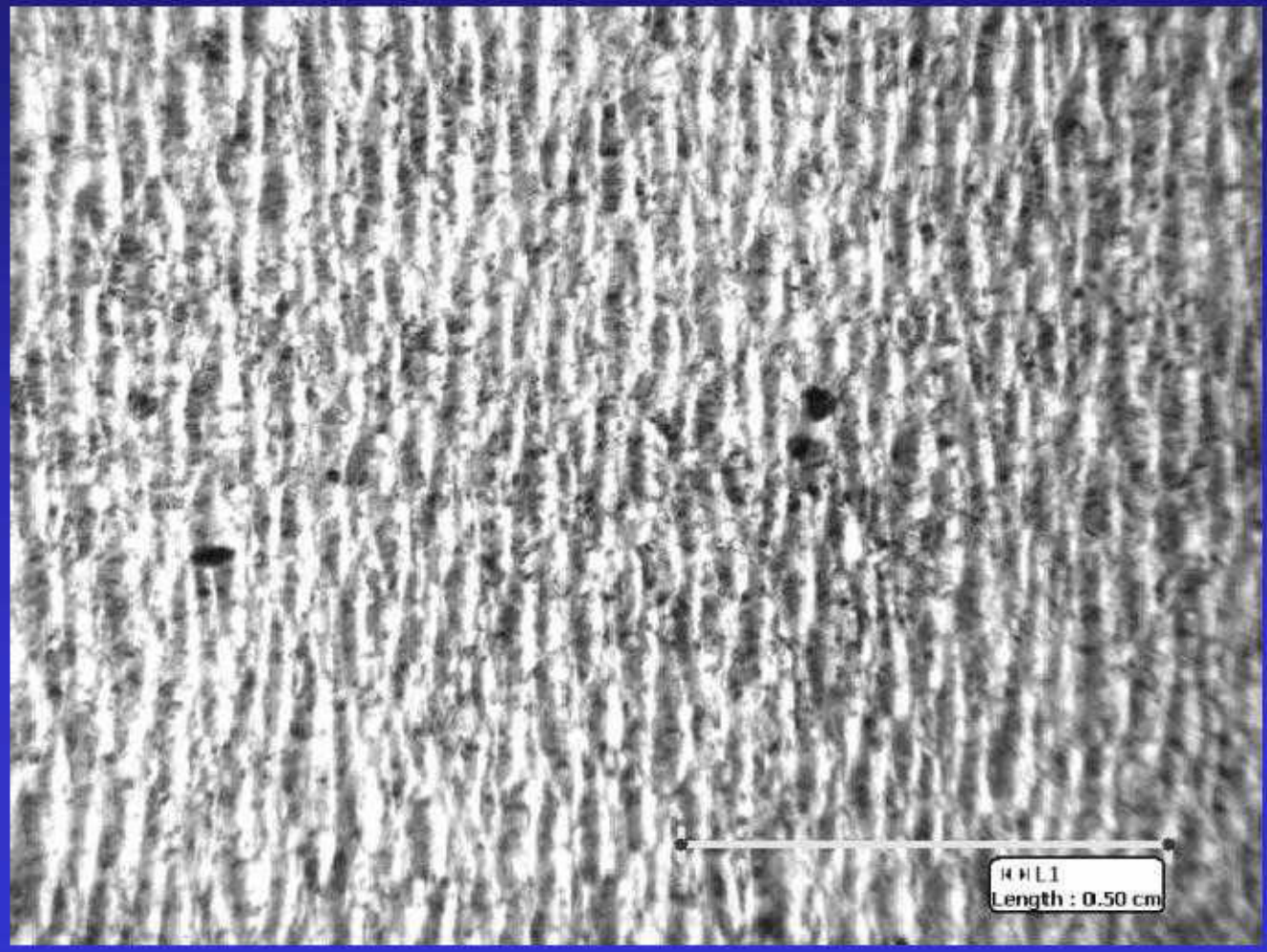


FORMATION AND THE CREPING TRANSFORMATION



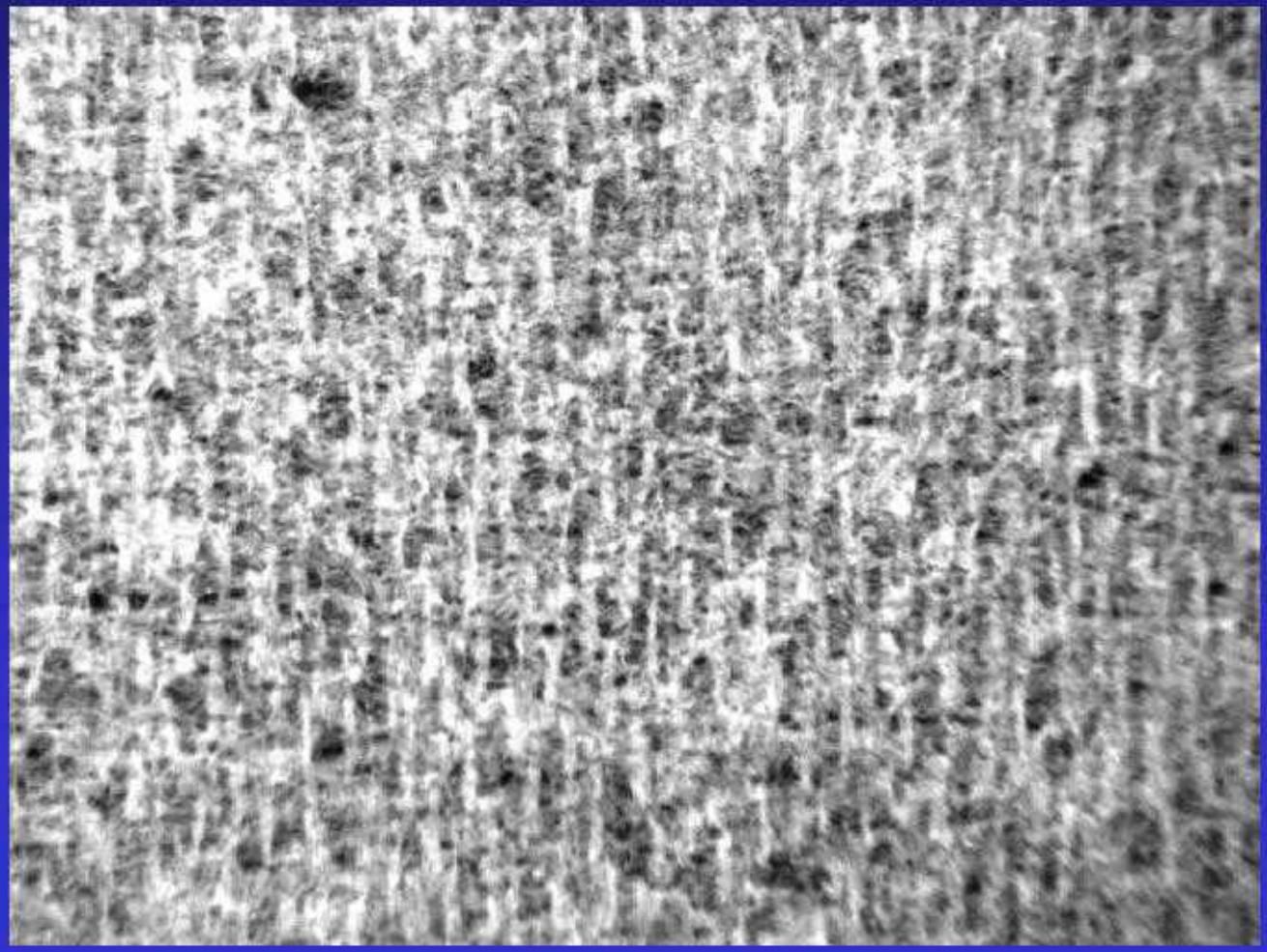
FFT TECHNIQUE / CASE STUDY A

Crepe Structure
10X



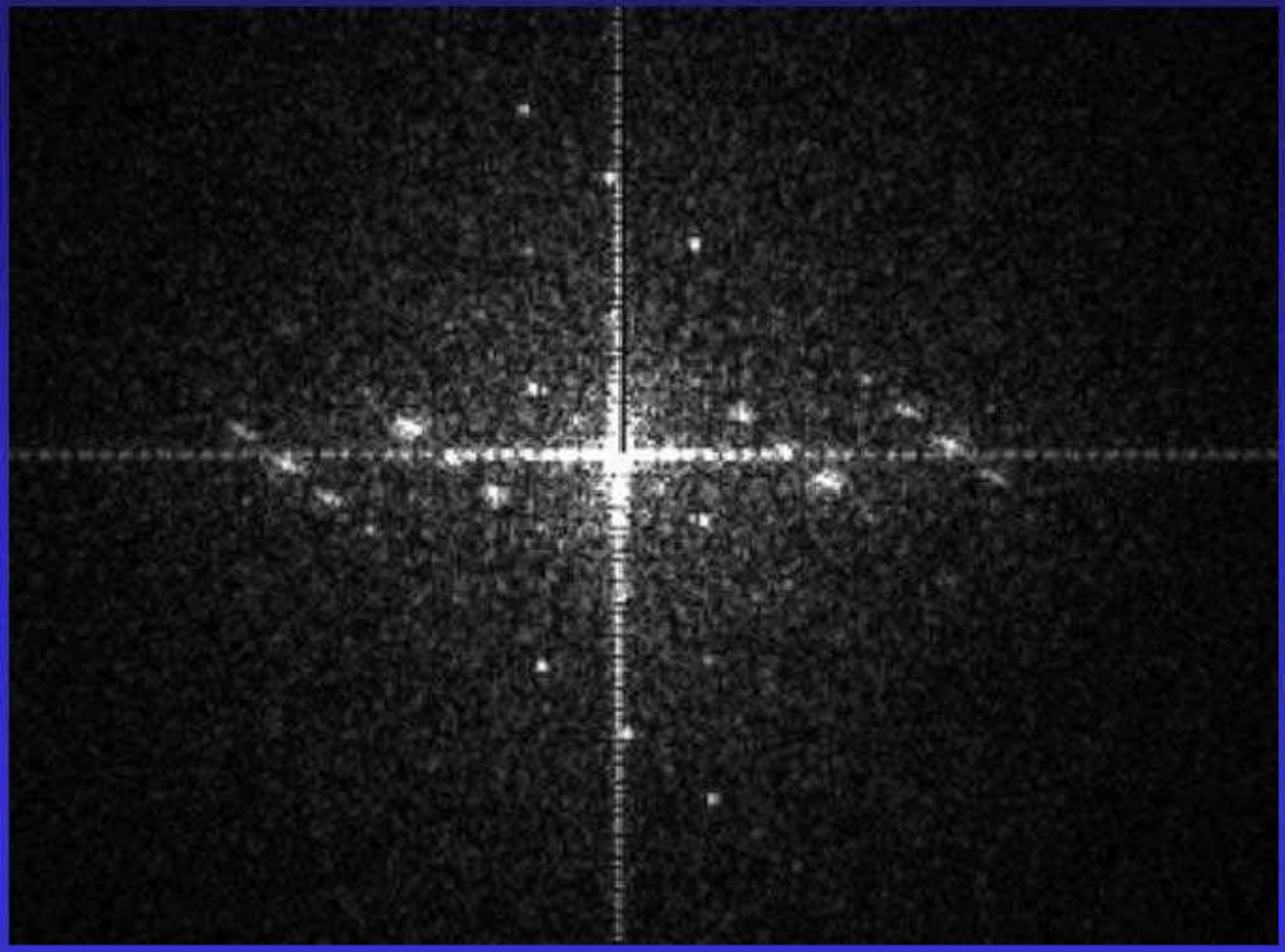
FFT TECHNIQUE

Formation
Original Image
10X



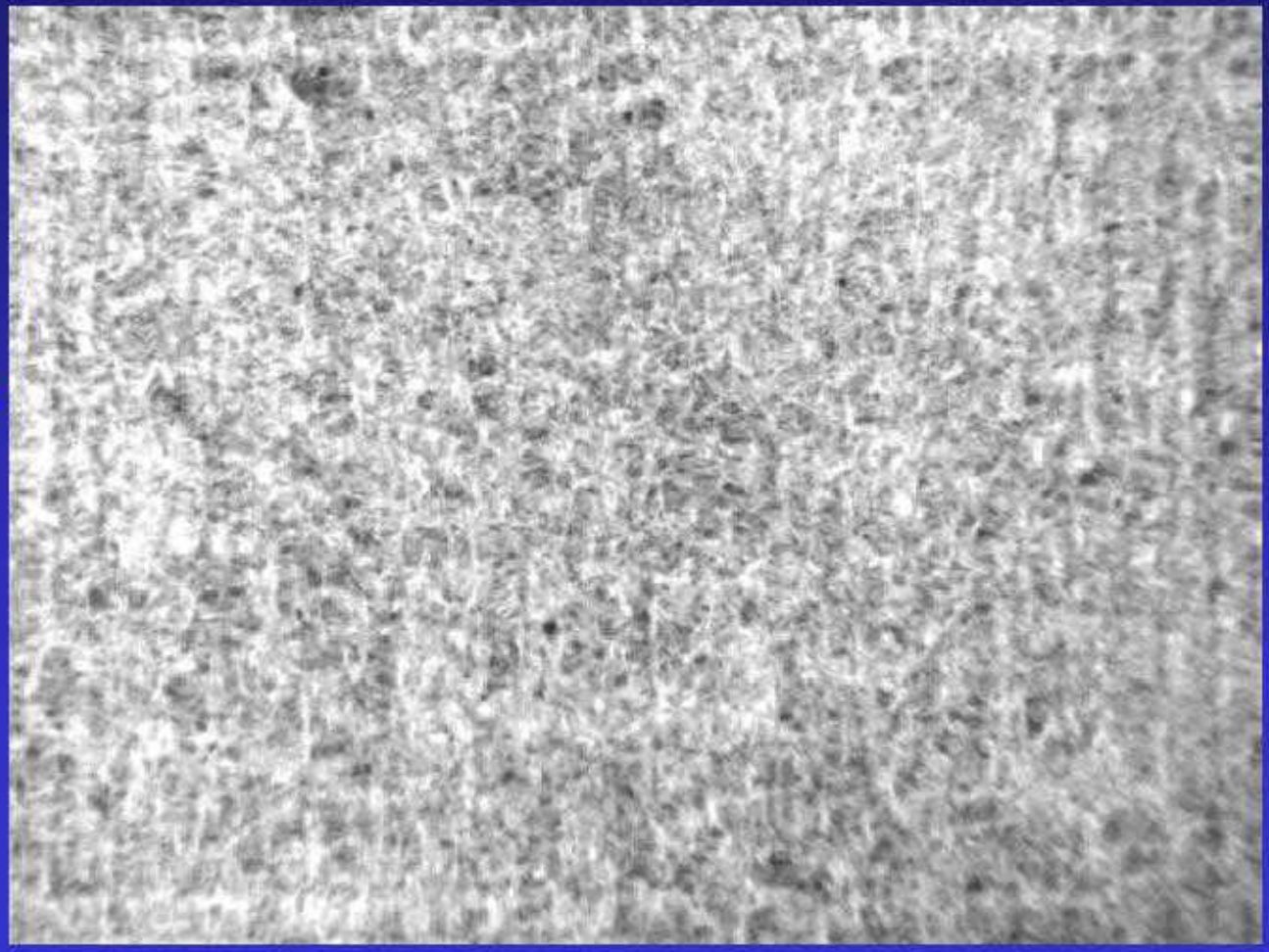
FFT TECHNIQUE

Frequency Spectrum



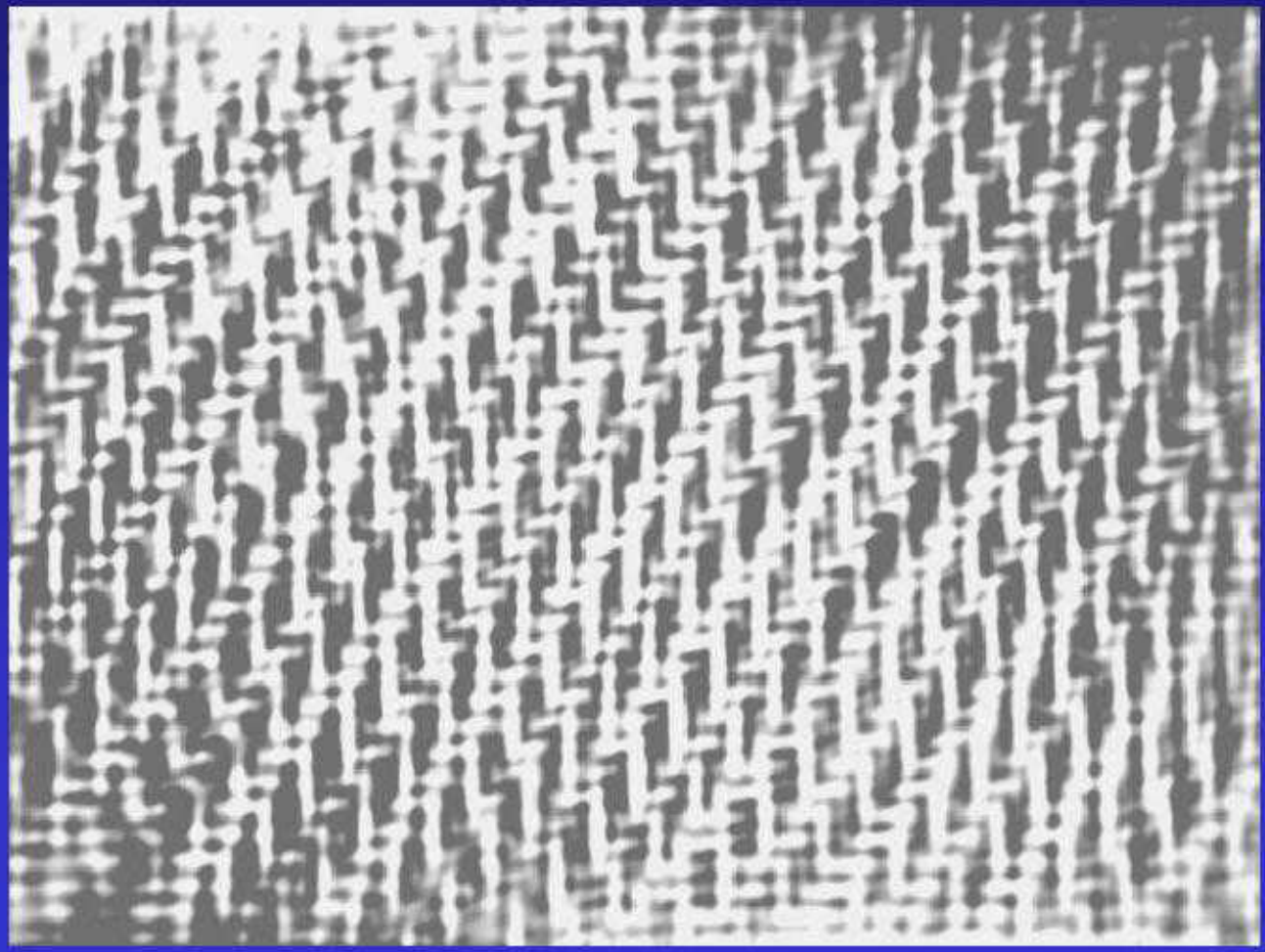
FFT TECHNIQUE

Original Image
With
Embedded Structures
Removed

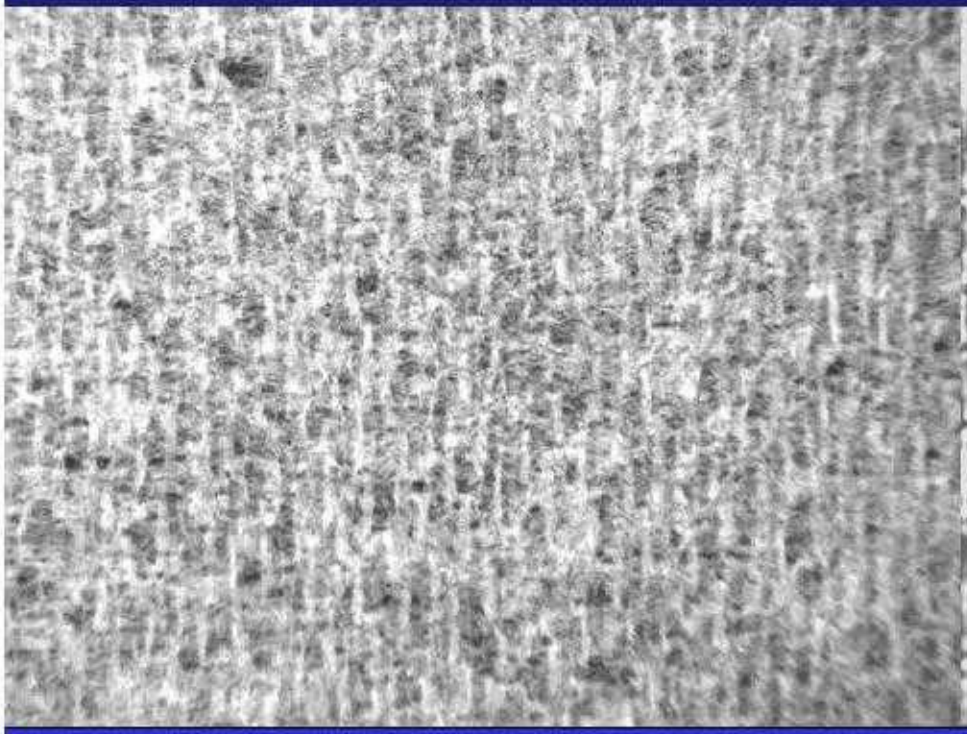


FFT TECHNIQUE

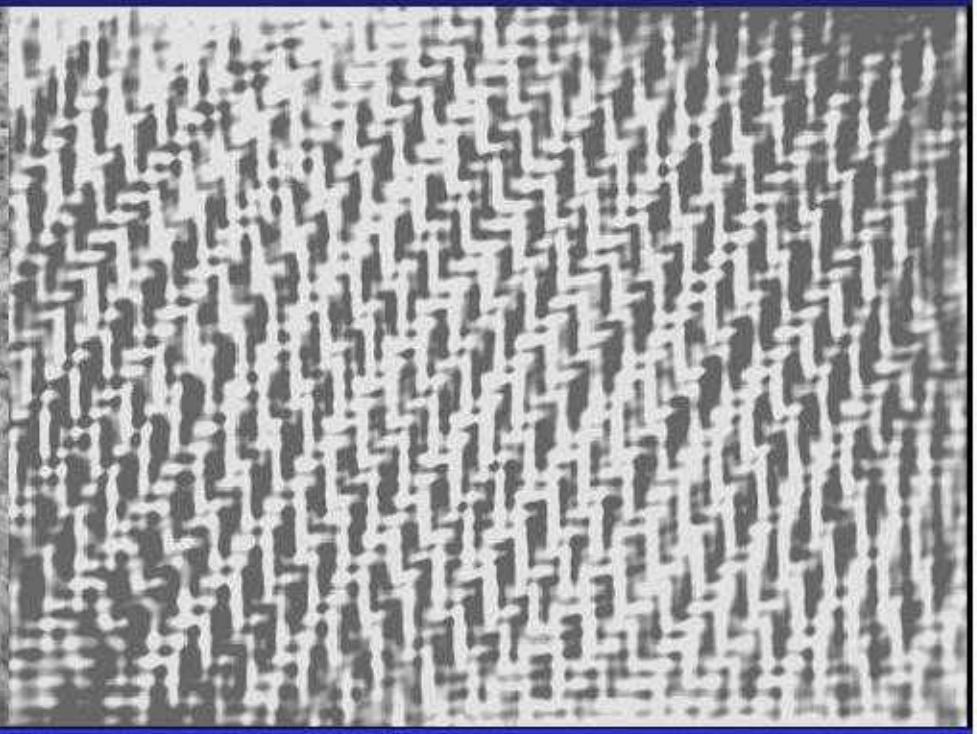
Embedded Structures



FFT TECHNIQUE

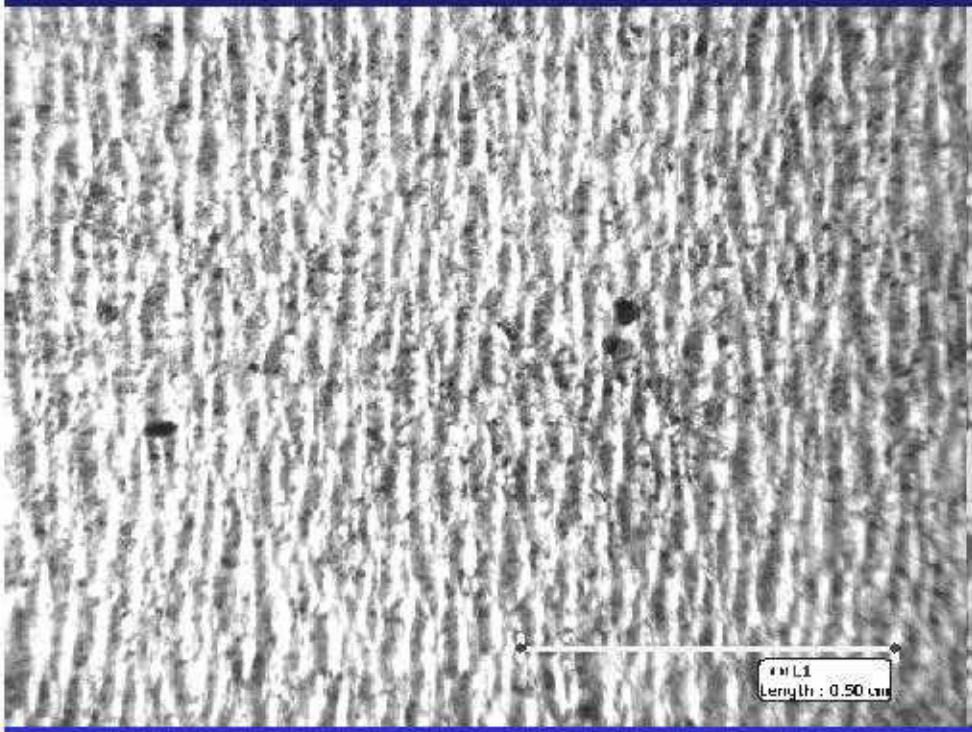


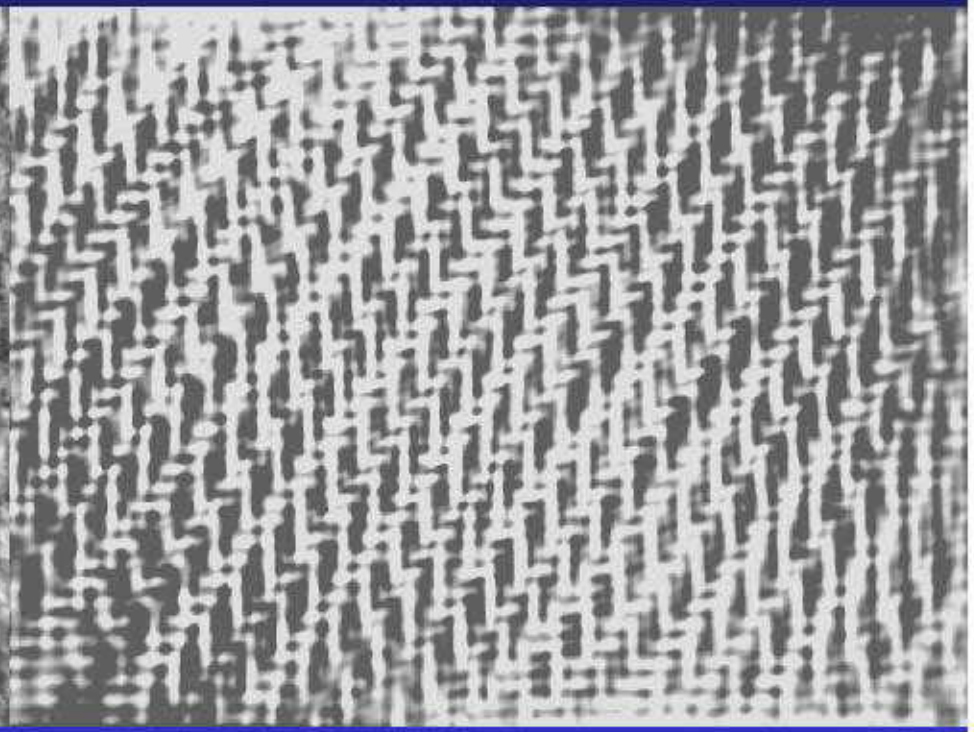
Original Formation Image



Embedded Structures

FFT TECHNIQUE



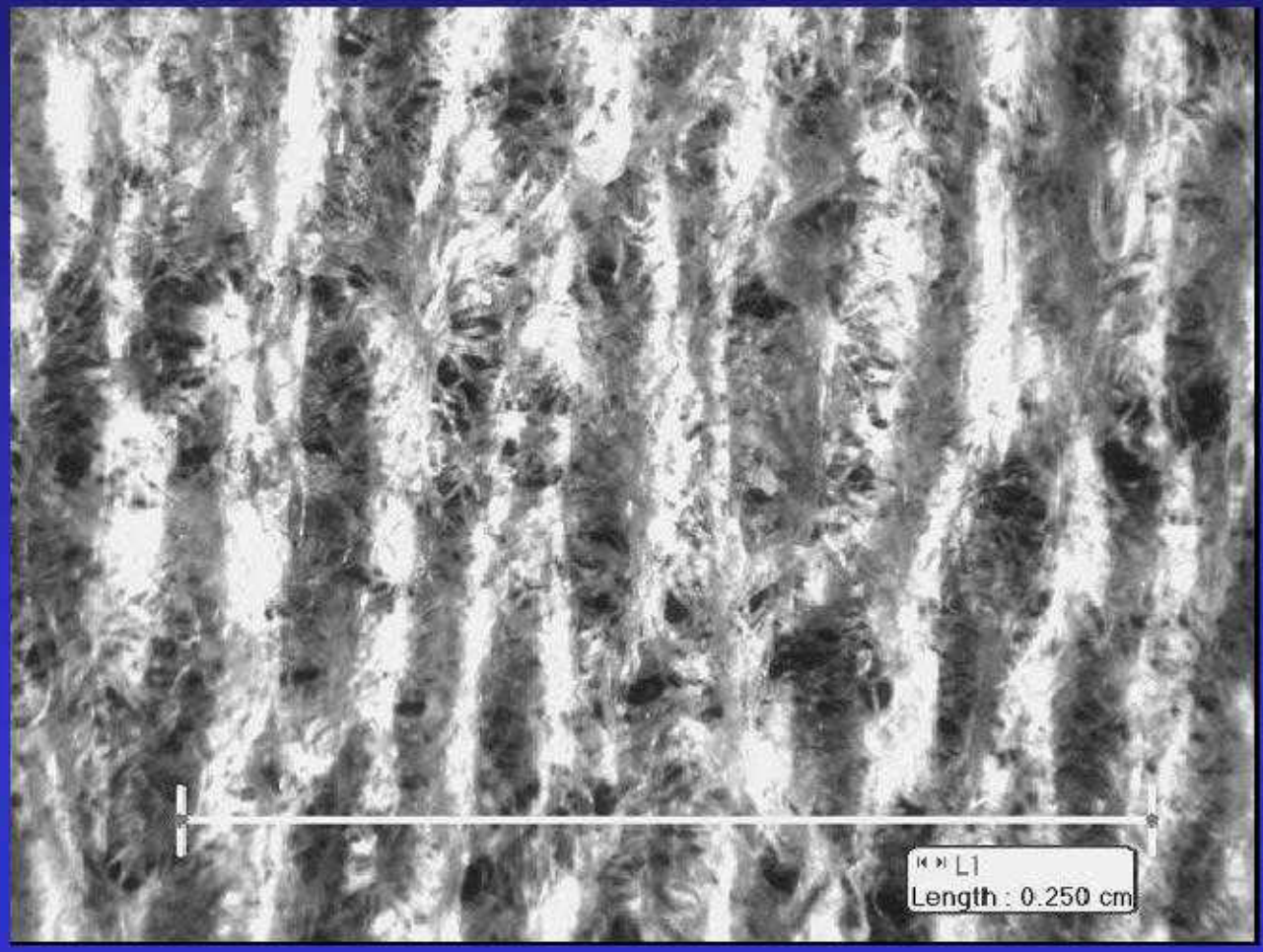


Crepe Structure

Embedded Structures

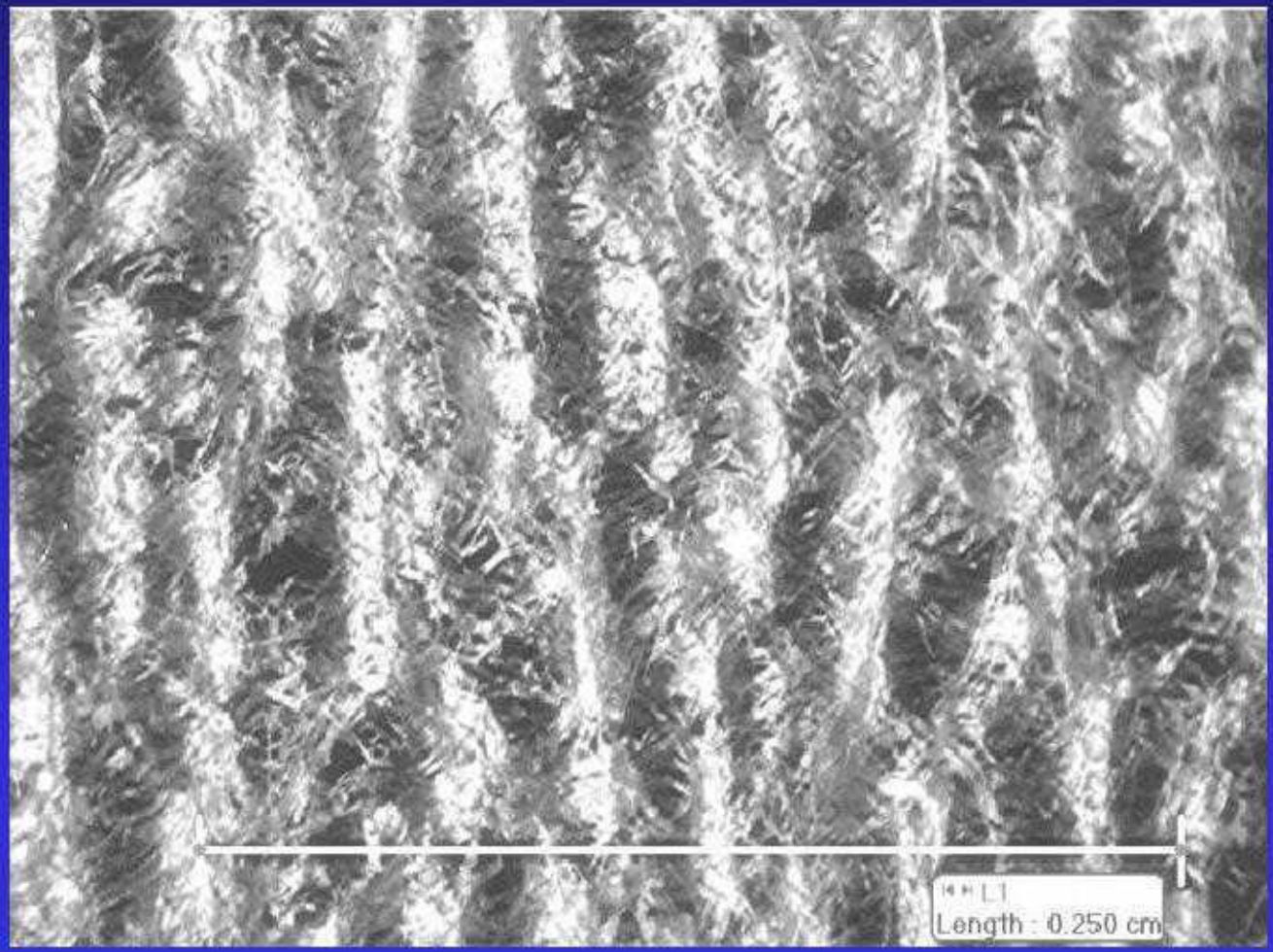
CASE STUDY A – BASE CONDITION

Crepe Structure
40X



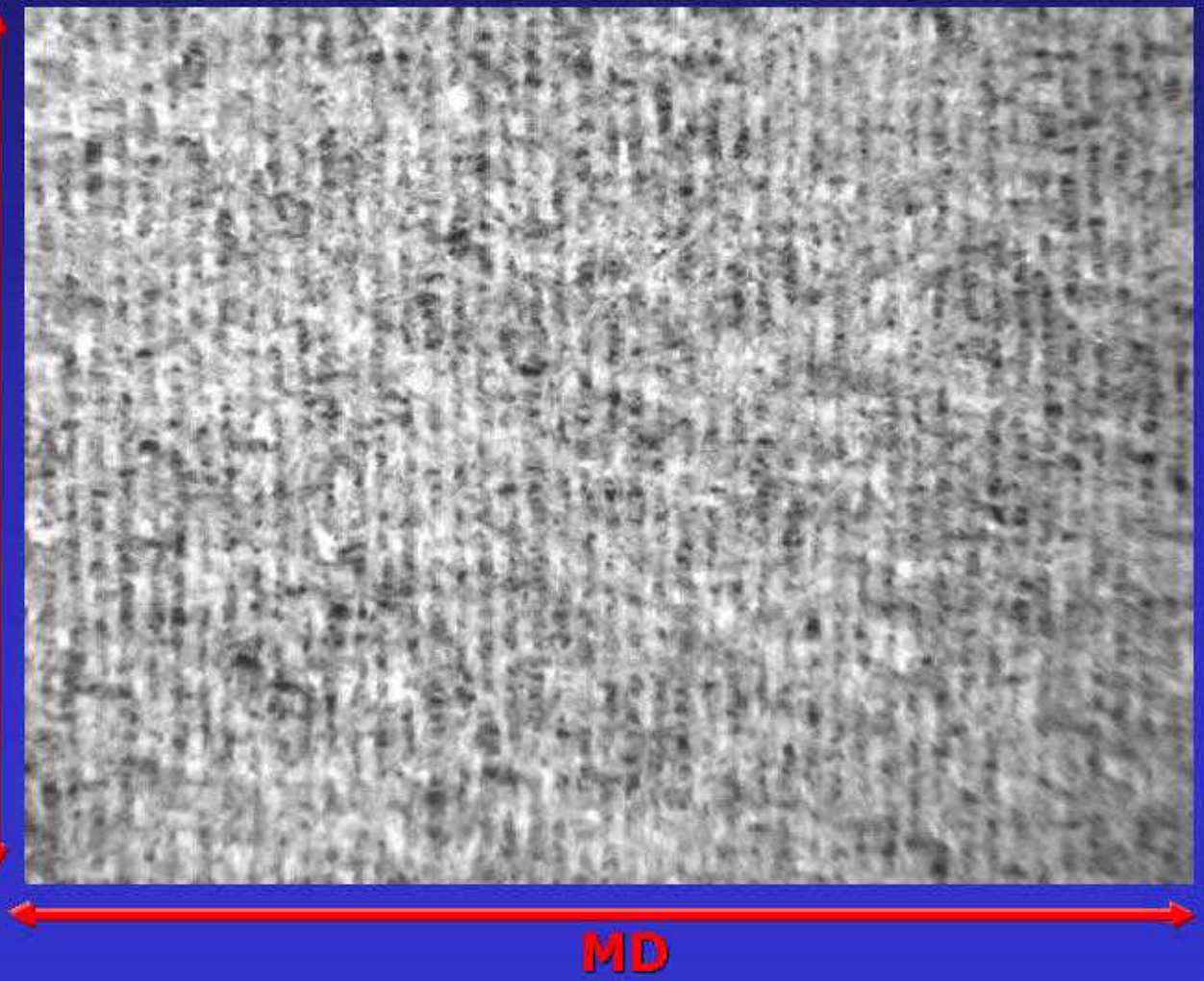
CASE STUDY A – TRIAL CONDITION

Trial Condition
Crepe Structure
40X



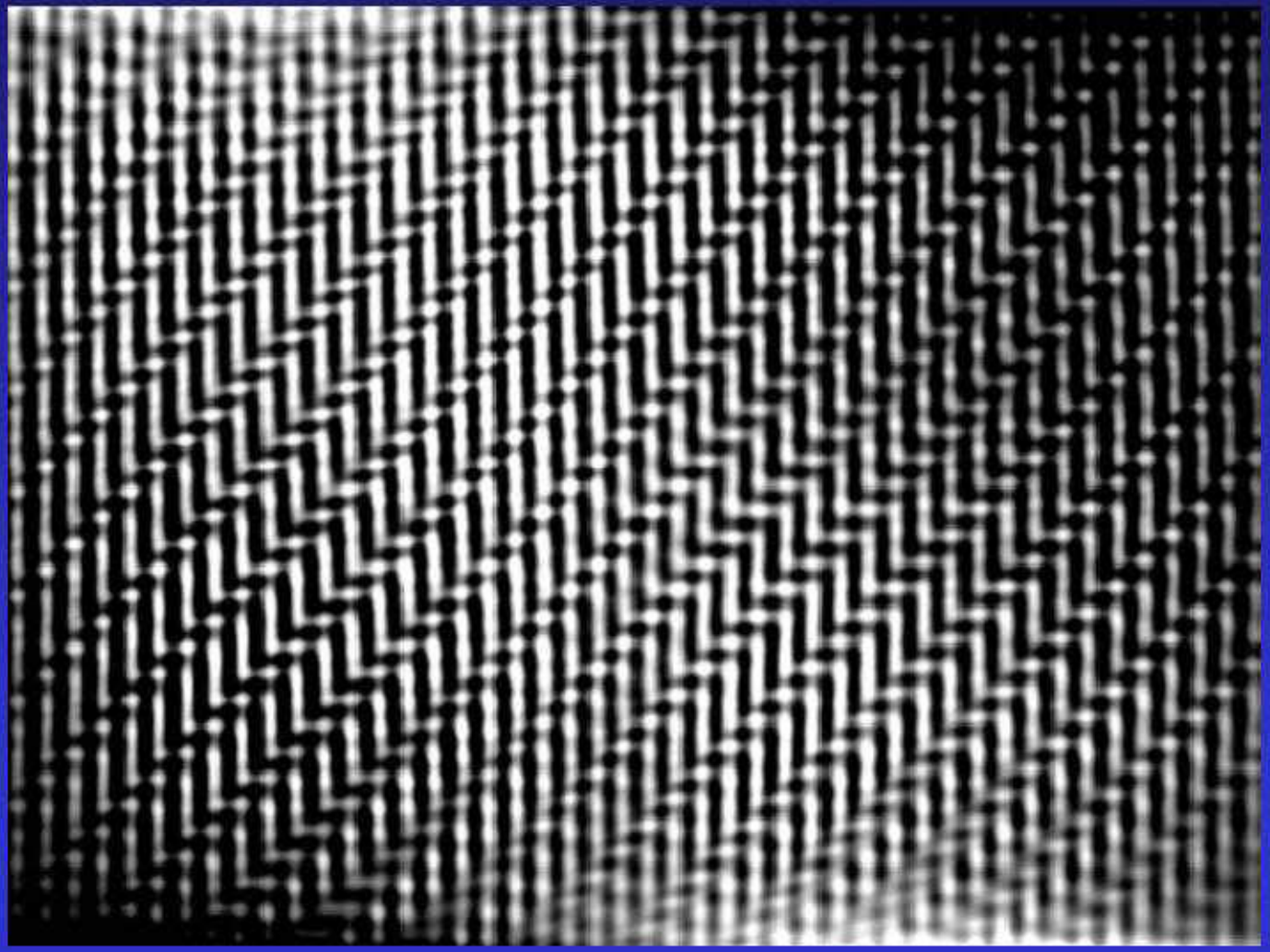
CASE STUDY B – OLD FABRIC FROMATION

Embedded Cross Directional Structures



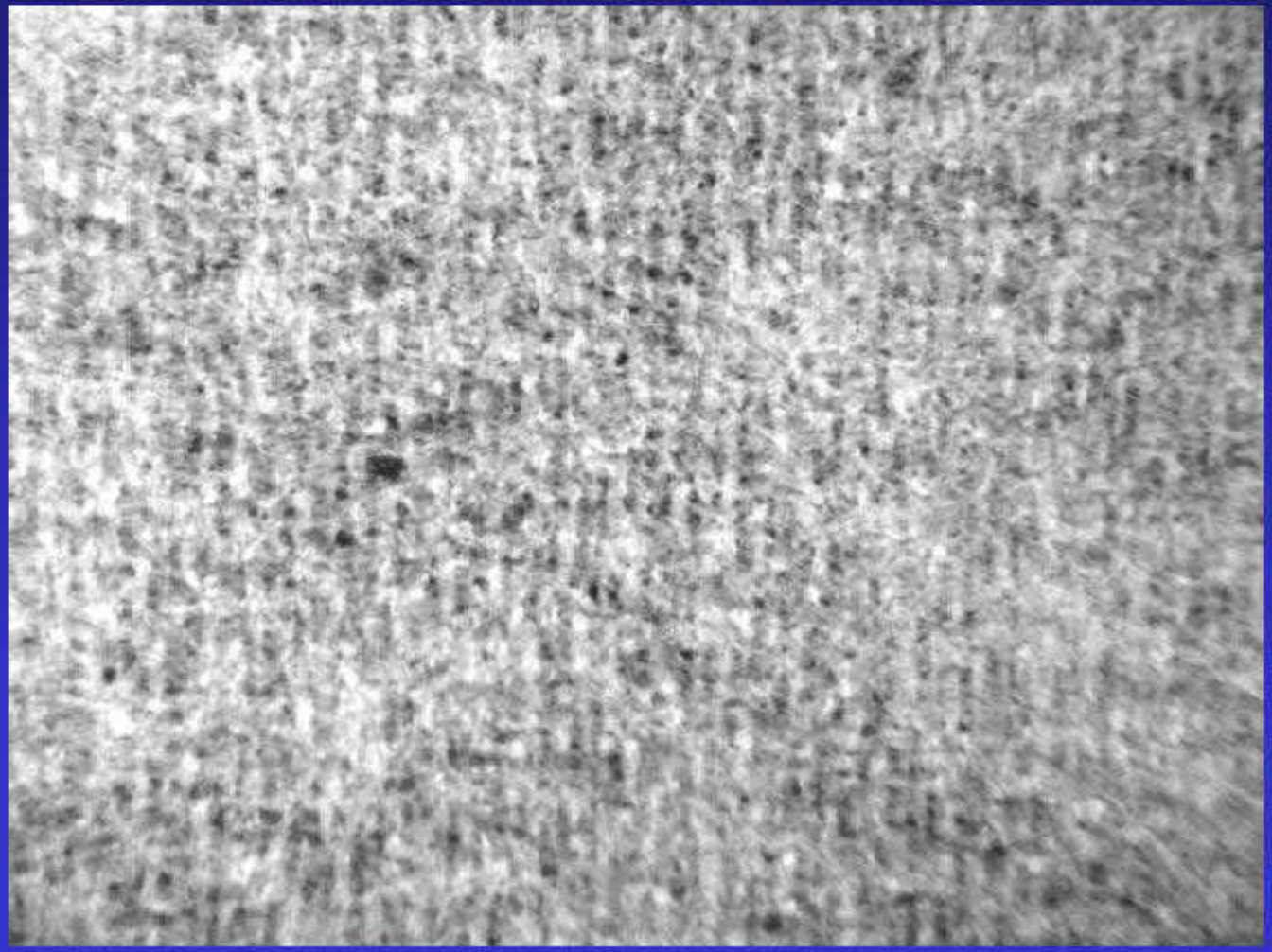
CASE STUDY B – OLD FABRIC

Embedded Structures



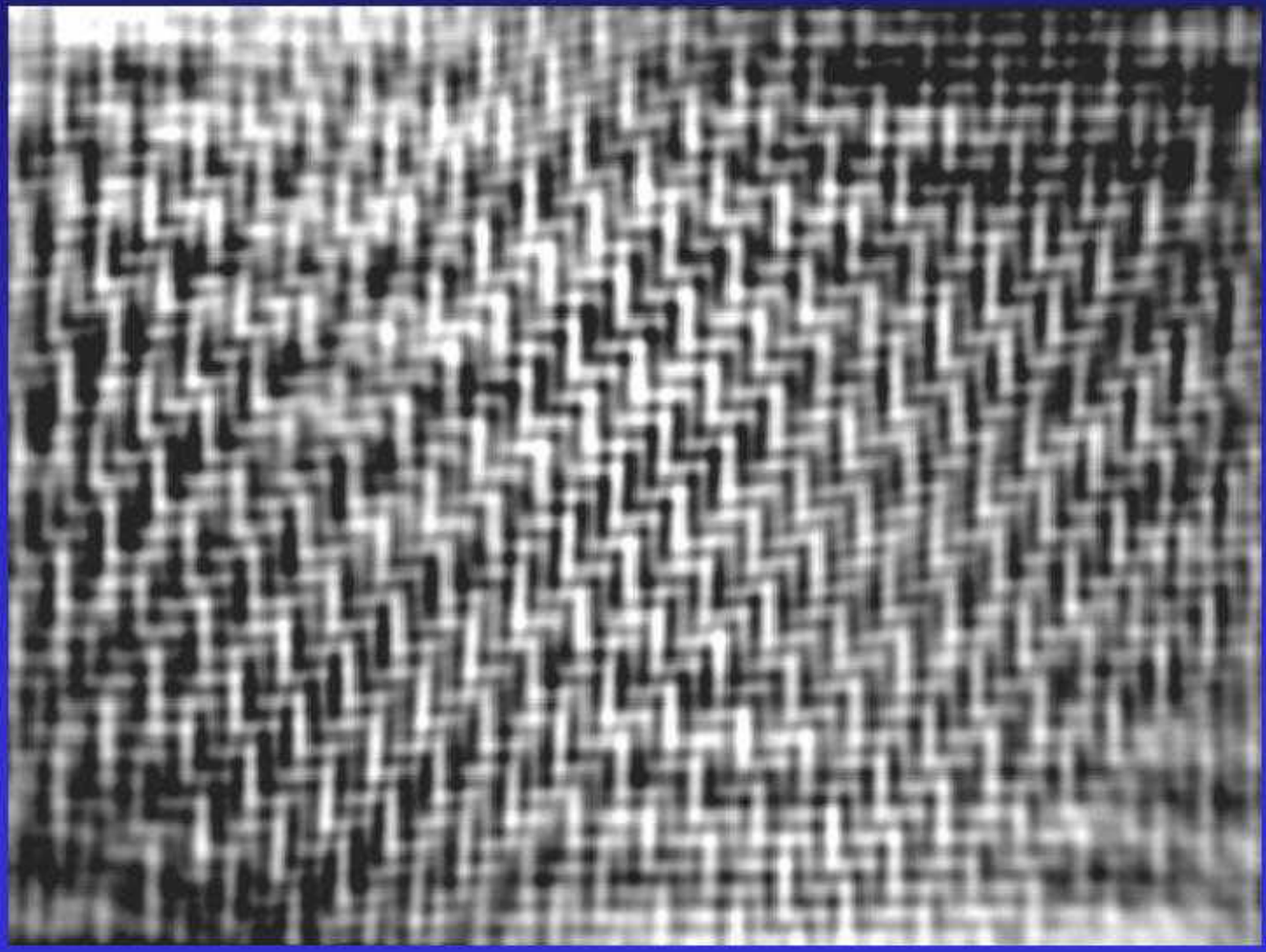
CASE STUDY B – NEW FABRIC FORMATION

Minimal Appearance of Embedded Structures

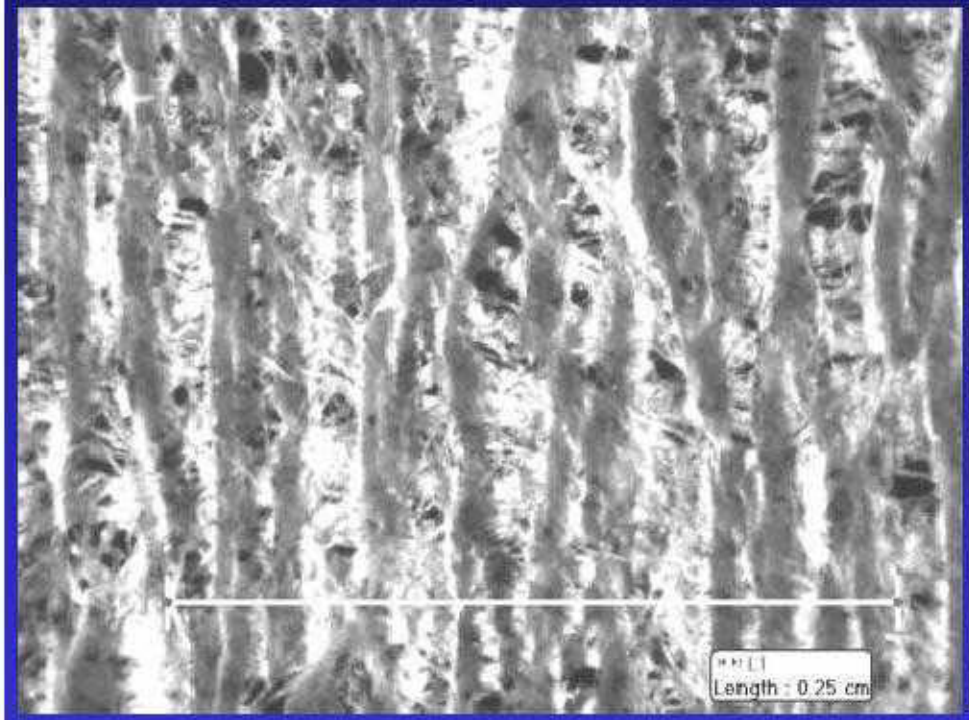


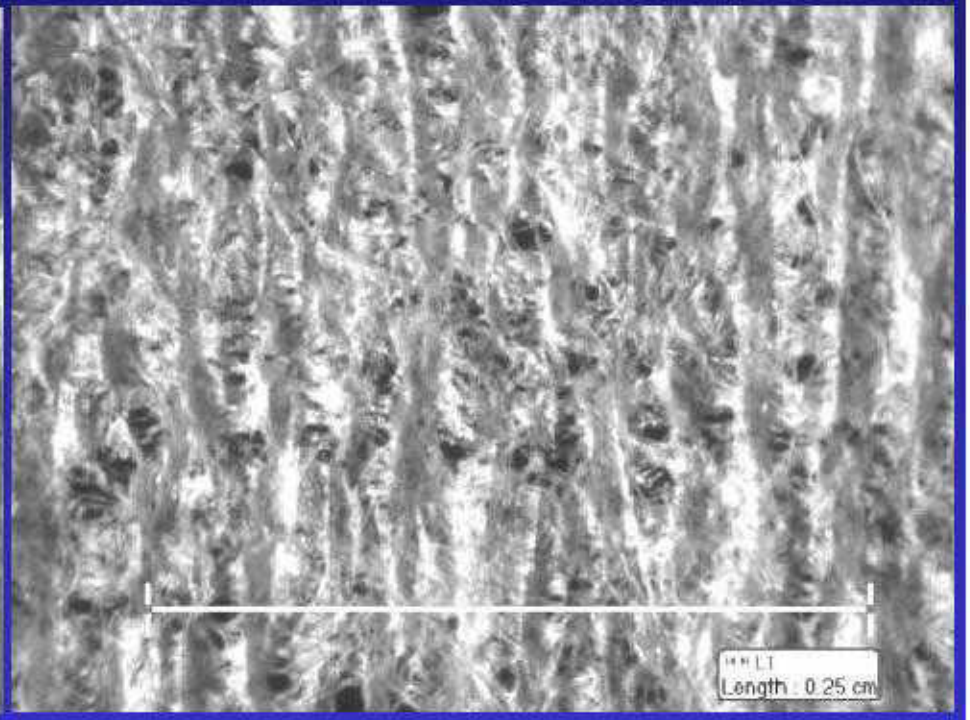
CASE STUDY B – NEW FABRIC

Embedded Structures



CASE STUDY – CREPE STRUCTURE OLD vs. NEW





Conclusions

- Wire design and the forming process can have a significant impact on the Embedded Structures within the tissue sheet.
- Embedded Structures can significantly impact the creping transformations and resultant characteristics.
- Fast Fourier Transform (FFT) technologies can open the door to understanding Embedded Structures and ultimately the potential of the creping process.