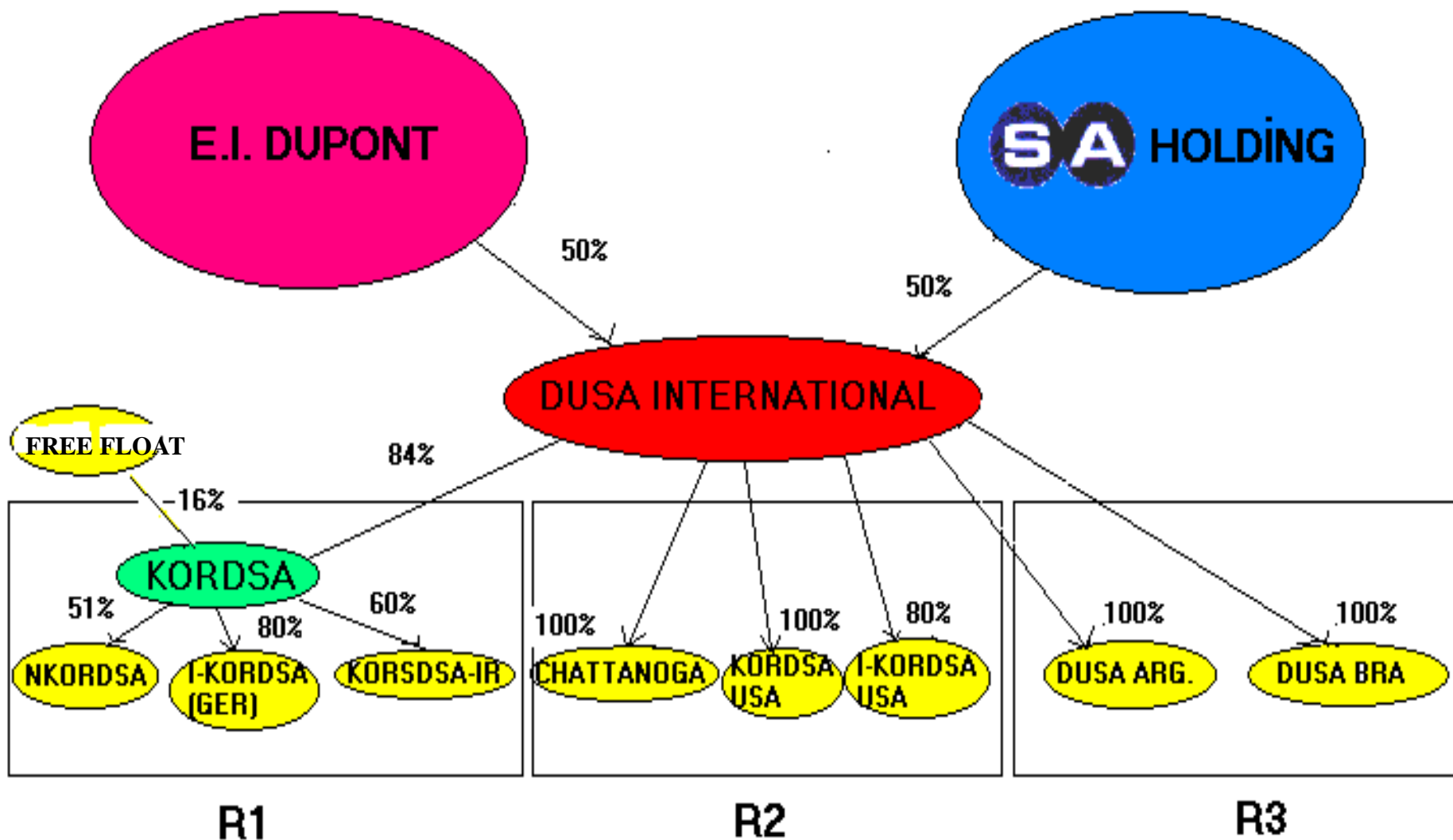


Production of High Tenacity Nylon for Ropes

Ahmet Yılmaz

Kordsa Turkey

08.03.2002, Turin





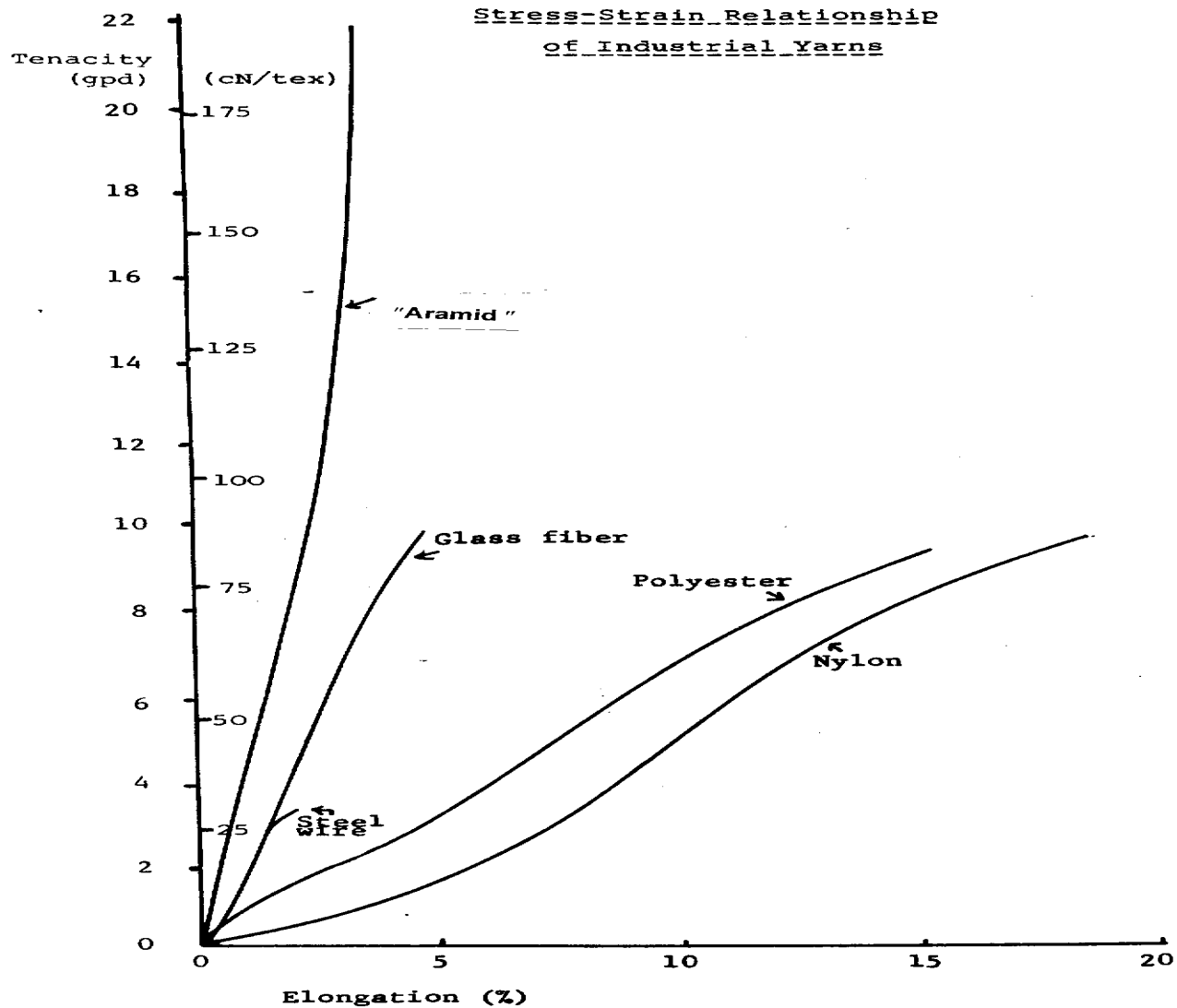
DUSA INTERNATIONAL

	1. Region	2. Region	3. Region	TOTAL
Turnover (MM\$/2001)	250	247	95	592
Employees	1137	617	546	2300
Production Sites	4	2	2	8
Production Capacities				
N6 Yarn	-	-	12	12
N66 Yarn	37	50	15	102
T & W	46	14	24	84
Dipping	47	14	23	84

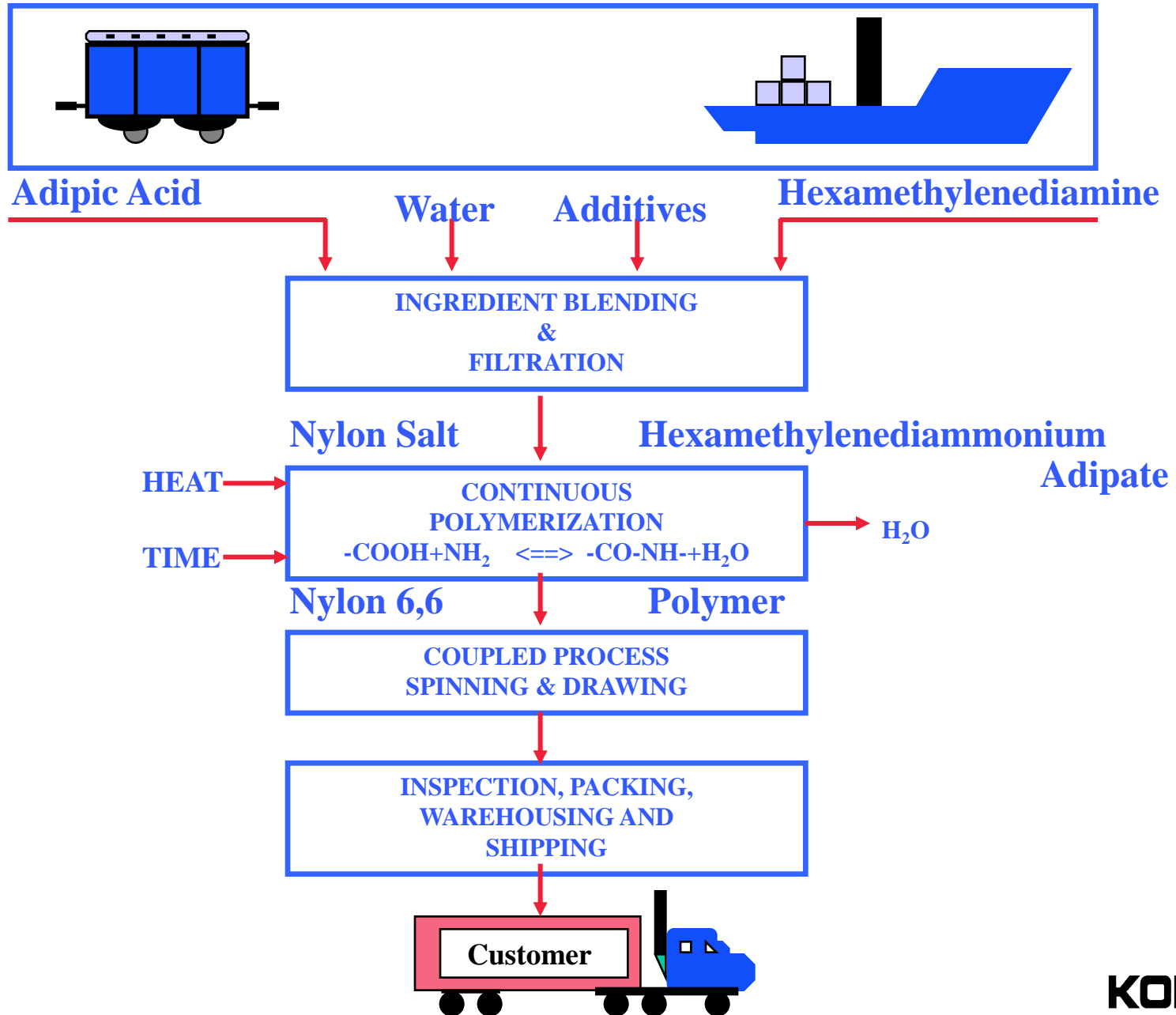
Comparison of the Properties of Materials

Properties	Aramid	Nylon	Polyester	Rayon
Strength	+++++++	++	+	+
Modulus	+++++++	++	+	+++
Impact Resistance	++	+++	+	+
Flexibility	+	+++++	+	++
Fatigue Resistance	+	+++++	++	++
Heat Resistance	+++++	+++	++	+++
Abrasion Resistance	+	+++++	++	+
Adhesion	+	+++	++	+++

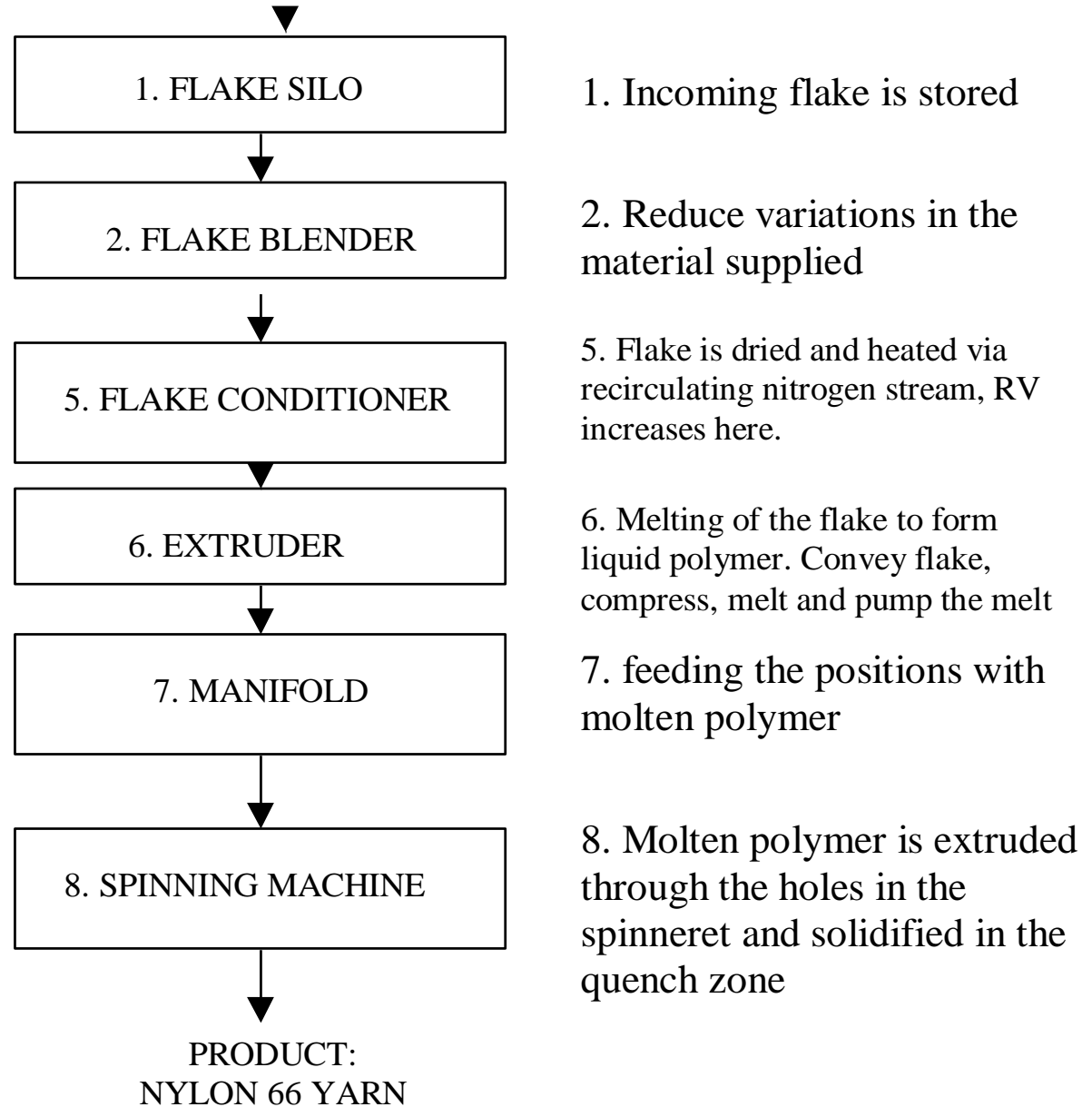
STRESS-STRAIN RELATIONSHIP OF YARNS



NYLON 66 T-25 PROCESS FLOW DIAGRAM

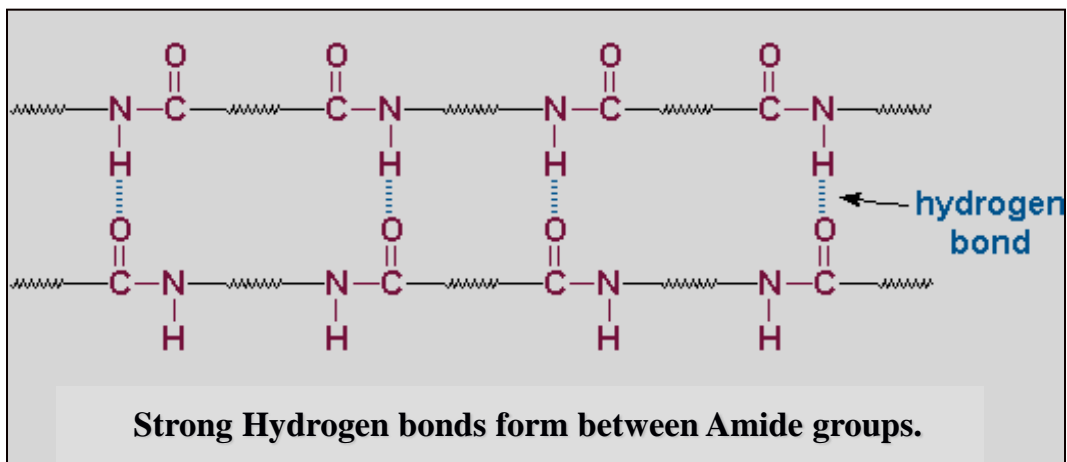
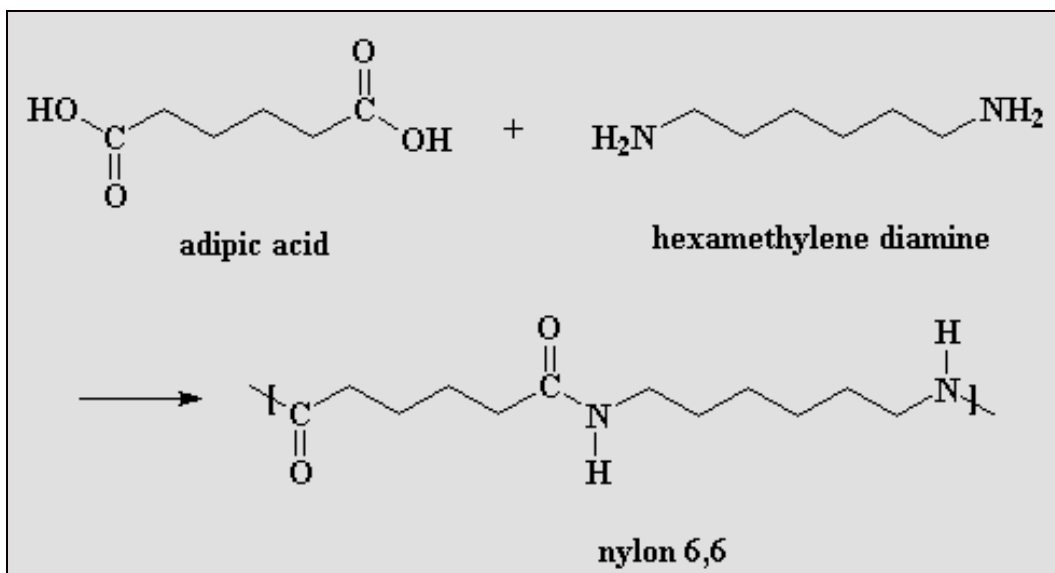


Kordsa T66 Process Flow Diagram



N66 YARN CHEMISTRY

Nylon 66 Polycondensation Reaction



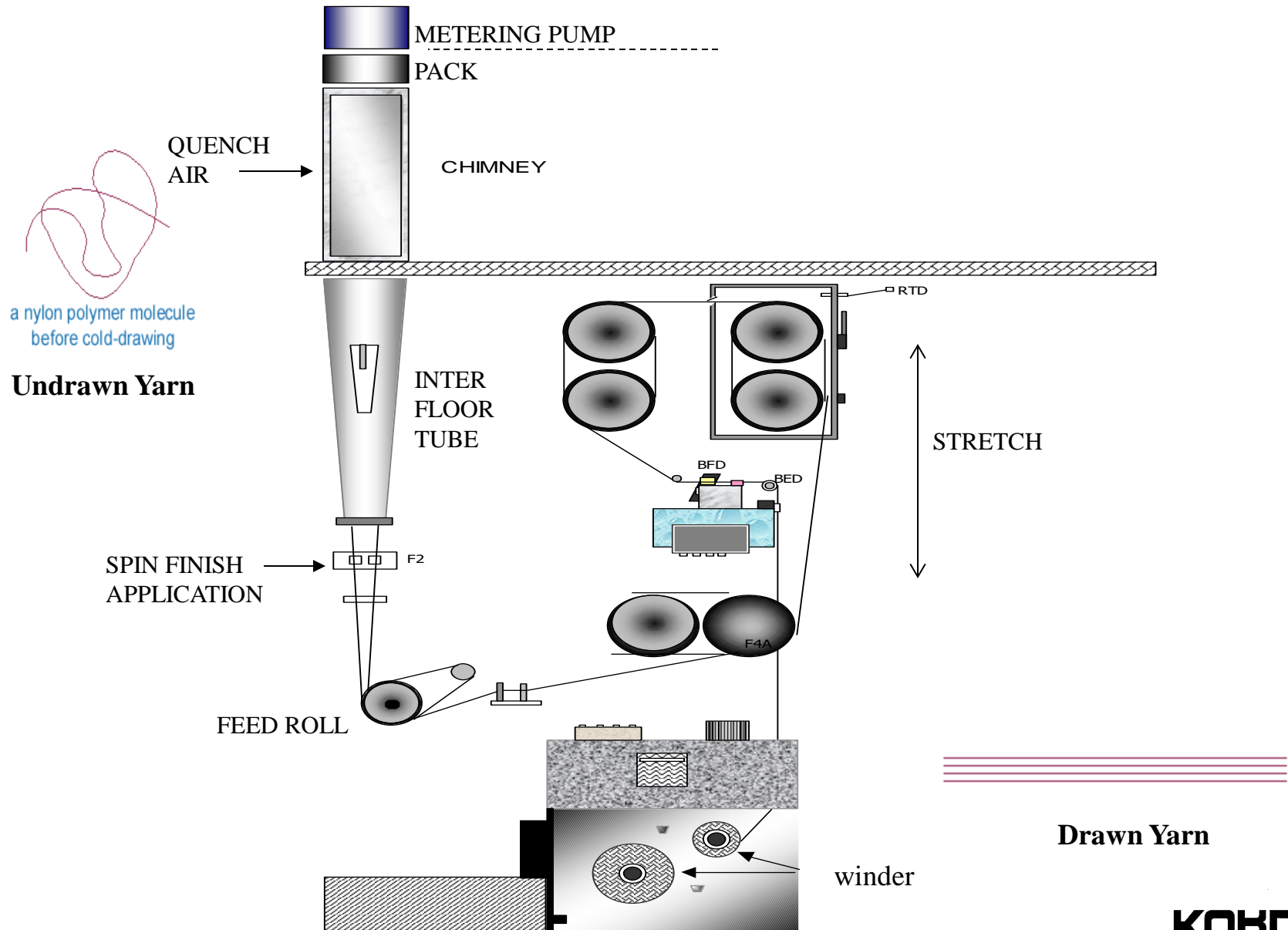
Tm: 265°C

Critical Process Parameters in Yarn Production

Polymerisation (T25)

- Amine and Carboxyl ends combine in a reversible reaction, to form amide links and water.
- Process is controlled to remove a precise amount of water and drive the reaction to achieve the required molecular weight

Nylon 66 Yarn Production- Spinning Process



Critical Process Parameters in Yarn Production

Spin Draw Machines

- Polymer is pumped through a filter pack, distributed within the pack
- Extruded through spinneret capillaries.
- Filaments are offset in straight lines across the spinneret for optimum quenching.

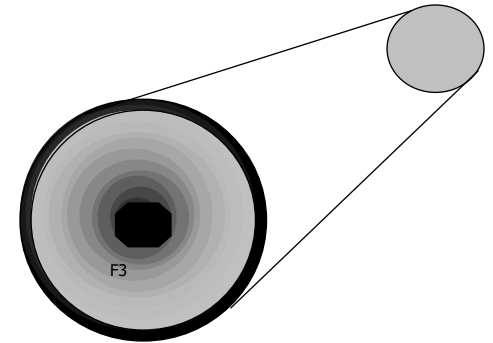
Critical Process Parameters in Yarn Production

Spin Draw Machines

- Yarn Filaments are quenched at the chimney to the desired temperature.
- Yarn contacts finish applicator which applies a controlled quantity of oil base finish to the yarn
- Finish application provides lubrication and antistatic properties required for processing.

Major Factors Affecting Spinning Process

- **Finish oil application (% FOY)**
- **BFD (Broken Filament Detector)**
- **Interlace Equipment**
- **Winding unit**
- **Cleanliness of yarn contact surfaces.**



KORDSA YARN TESTING AND QUALITY CONTROL SYSTEM

SAMPLING SYSTEM

EACH SHIFT - 8 hour period middle of the shift samples are taken

- 4 bobbins are selected each shift on spinning machine for physical properties testing.
- Samples are taken to the lab within one hour after sampling

shift	time for sampling
24:00-08:00	05:00
08:00-16:00	13:00
16:00-24:00	21:00

KORDSA YARN TESTING AND QUALITY CONTROL SYSTEM

- Process is kept on target, with on aim process control, statistical control
- Continuous control of the process to the aim point for each quality characteristic is maintained.
- Labelling and quality control system ensures the delivery of best quality yarn product to the customer.

KORDSA YARN TESTING AND QUALITY CONTROL SYSTEM

LAB. CONDITIONS

Temperature: $24 \pm 2^{\circ}\text{C}$ relative humidity: $55 \pm 2\%$

All nylon yarns are conditioned for at least 4 hrs in the lab before testing

Prior to testing, the surface layer of yarn (approximately 3m) is wrapped off the bobbin and discarded

For all tests other than shrinkage, 120twist is inserted into the sample

Controlled Physical Properties

- Instron CRE (constant rate of extension) machine
- Breaking Force
- Elongation at Load
- Elongation at break
- Shrinkage
- Linear density
- Spin finish level

Typical Inherent Material Properties

Typical Inherent Material Properties	
Cross Section of Individual Filaments	circular
Specific gravity g/cm ³	1,14
Melting Point °C	254
Thermal Conductivity (W*m ⁻¹ *K ⁻¹)	0,24
Coefficient of expansion (° C ¹)	-7,2*10 ⁻⁵
Moisture regain at 65% RH and 20°C	4.0%

KORDSA T728 NYLON 66 YARN

NOMINAL PHYSICAL PROPERTIES

	KORDSA T728 YARN			
DTEX	940	1400	1880	2100
BREAKING FORCE (N)	81,4	123,2	162	180
EXT. AT BREAK (%)	18,6	18,8	19,5	20,2
EXT. AT 45 (N) SET FORCE	9,6	7,9	6,9	6,8
%SHRINKAGE LENZING 177degC	6,6	6,3	6,2	5,7
FINISH ON YARN (NI-29) (%)	0,9	0,9	0,9	0,9
NUMBER OF FILAMENTS	140	210	280	280

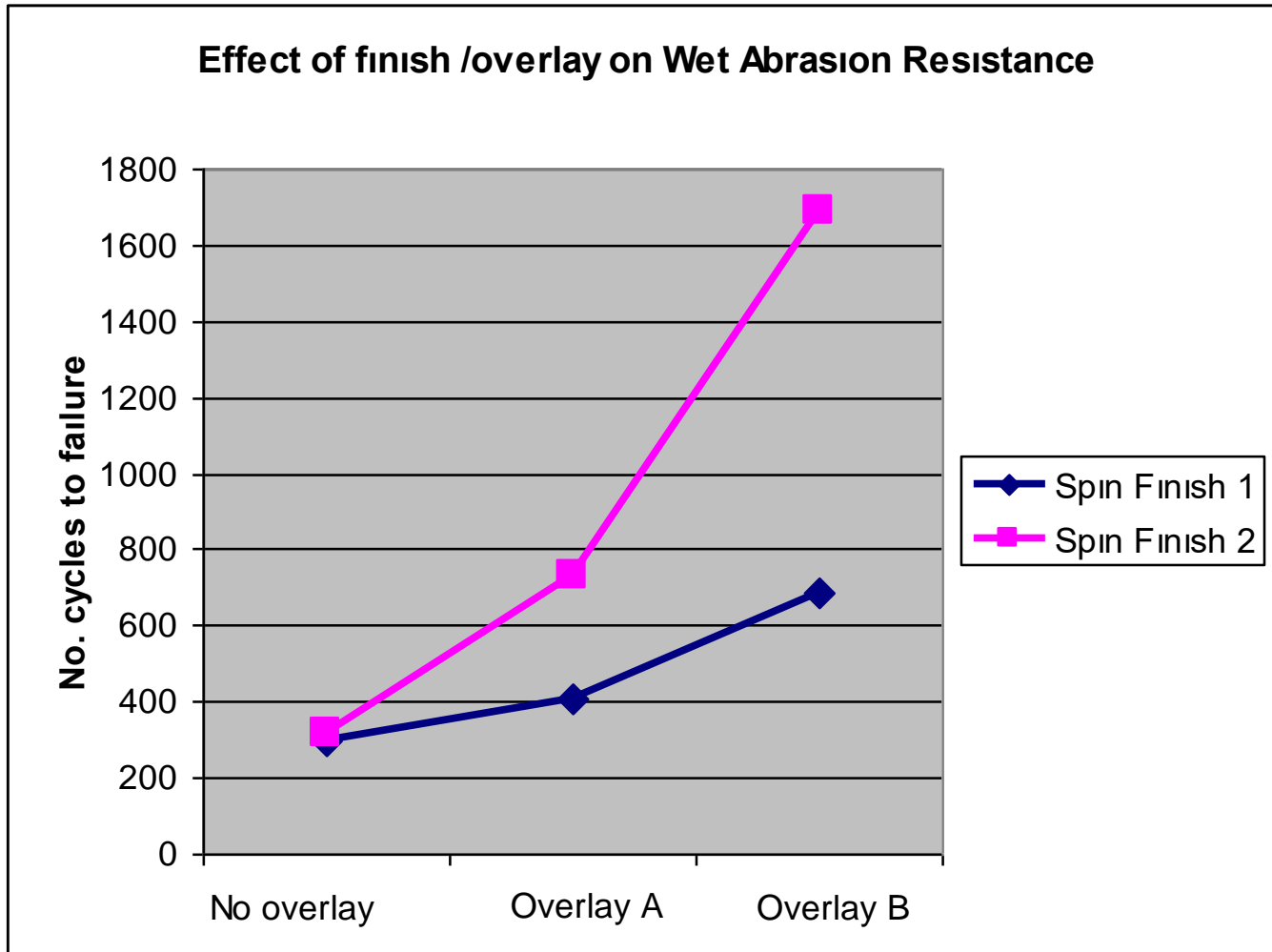
KORDSA T802, HIGH TENACITY NYLON 66 YARN NOMINAL PHYSICAL PROPERTIES

	KORDSA T802 YARN		
DTEX	940	1400	1880
BREAKING FORCE (N)	85,4	129,0	169,9
EXT. AT BREAK (%)	17,2	18,2	19
EXT. AT 45 (N) SET FORCE	9,3	8,2	7,5
%SHRINKAGE LENZING 177degC	7,2	6,3	6,5
FINISH ON YARN (NI-29) (%)	0,9	0,9	0,9
NUMBER OF FILAMENTS	140	210	280

Wet Abrasion Resistance

- Dusa L.L.C is conducting R&D work to improve wet abrasion resistance of our products.
- Spin finish and additional overlay finish play critical role in this.
- There is a strong interaction between spin finish and overlay type.

Effect of Spin Finish on Wet Abrasion Resistance



Thank you...

Gracia

Vielen Dank