From Wood Science to Forest Products Research Policy: A Chemical Engineer's Fulfilling Journey

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Academy Lecture Presentation At the IAWA/IAWS Meeting Madison, Wisconsin June 24, 2010

In the Beginning



Early realistic goals



Apprehensive at a young age

A Mathematical Chemical Engineering Approach



A New World Opens



From Refinery to the Forest







Key Books in Wood Science for my Transformation

- 1. Textbook of Dendrology by Harlow and Harrar (1958)
- Textbook of Wood Technology Vol. I Structure, Identification, Uses, and Properties of the Commercial Woods of the United States by Panshin, de Zeeuw, and Brown (1964)
- Textbook of Wood Technology Vol. II The Physical, Mechanical, and Chemical Properties of the Commercial Woods of the United States by Brown, Panshin, and Forsaith (1952)
- 4. Principles of Wood Science and Technology: Solid Wood v. 1 by Kollmann and Cote (1968)

Dimensional Stability: Wood Plastic Composite



Wood Drying Methods

- 1. Jet impingement drying
- 2. Solar dehumidification drying
- 3. Pressure steam drying
- 4. Psychrometry
- 5. Conventional kiln drying with energy recovery

Wood Drying Defects





Casehardening





Conventional Kiln Drying Havco Wood Products Kilns in Missouri



Jet Impingement Drying



ADJUSTMENT OF JETS IN DRYER BOX RIGHT JET PLENUM 0 0 0 AIR IN 0 0 0 LEFT JET 0 PLENUM 0 -AIR IN DJUSTING ROD AND WHEEL

Solar Dehumidification Drying



Beverage Can Solar Collectors



Pressure Steam Drying





Wet/Dry Bulb Psychrometry



Energy Recover in Kiln Drying





Mathematical Modeling

DRYING CURVE

$$E = 1 - \dot{E}_0 \int_0^t exp(-at^{1/b}) dt$$

where
$$\dot{E}_0 = \frac{a^b}{b\Gamma(b)}$$

a is the rate factor

b is the bend factor

Fit of Model to Experimental Data



Summary Chapters in Books

 Rosen, H.N. 1987. Recent Advances in the drying of solid wood. In: <u>Advances in</u> <u>Drying</u>, Hemisphere Publishing Co

 Rosen, H.N. 1995 Drying of Wood and Wood Products. In: <u>Handbook of</u> <u>Industrial Drying</u>, Marcel Dekker

1st International Drying Symposium Skeleftea, Sweden 1987





IUFRO World Congress Kuala Lumpur, Malaysia 2000





Policy Area of Emphasis

- 1. Recycling of wood and products
- 2. Biomass conversion small diameter trees
- 3. Energy Conversion Ethanol and direct burning
- 4. Nanotechnology

Recycling of Wood and Paper Products









Forest fires threaten homes



Frank Franklin II / Al

Thinning Ponderosa Pine, New Mexico(Sept. 11, 2001)





Biomass conversion



Biopower from Wood





The Carbohydrate Economy (Cellulosic Biorefinery)









Nanotechnolgy



- Scale: 1 nm 100 nm (1 nm = 1 billionth or 10⁻⁹of a meter)
 Creating nanoscale size materials does not mean nanotechnology is involved
- Material must have unique properties (e.g. electrical, physical, chemical, optical) that are different that the bulk properties
- Achieving those unique properties must be repeatable and controllable

Federal Role in Nanotechnology R&D

- Support sustainable forestry and sustainable forest products as a positive economic, social, and ecological force within the US and internationally
- Promote, conduct, and support high risk, fundamental nanotechnology research
- Acquire and maintain state of the art Federal R&D nanotechnology facilities and provide access to unique and cost effective research facilities and capacities with other partners to move the US forestbased economy forward

Wood Culture Definition:

The human use of and activities with wood, as well as attitudes toward wood, wood products and wood-related environments

"The value and the way we use wood in our society"

Early Clearing of forests and use of wood in the United States



Bai door

XiZhou (Happy Village) Yunnan Province, China



IUFRO 5.10.01 Wood Culture

About the Working Party:

Wood Culture is an interdisciplinary science area which provides a better understanding of the use and social aspects of wood from a cultural perspective.

Research in Wood Culture improves people's relationship with nature and opens new ways to understand wood from an economic, environmental, and social value perspective.

Thank You