RFID (WIRELESS IC TAG)-REWRITABLE COMPLEX MEDIA
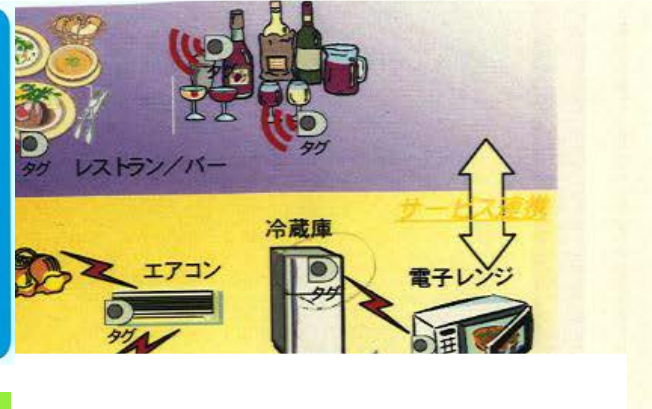
APPLICATION OF RFID (WIRELESS IC TAG)

Life Support

- Real-Time Life Information
- Health Control

Food Control

- Proposed Menu
- Automatic Calorie Accusation
- Tracerability
- Products Information

Intelligent Transportation System

- Car Owner Identification
- Car History
- Real-Time Traffic Information
- Anti-Collision

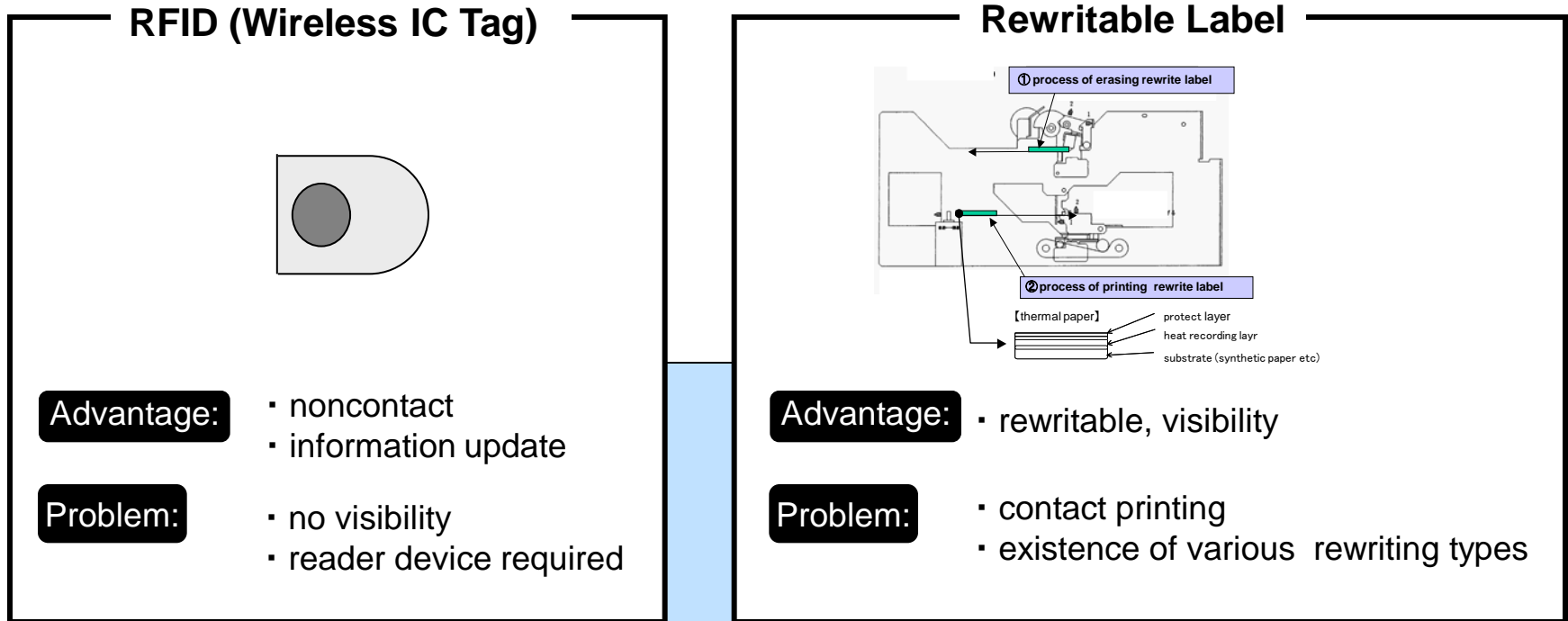**Intelligent Home Network**

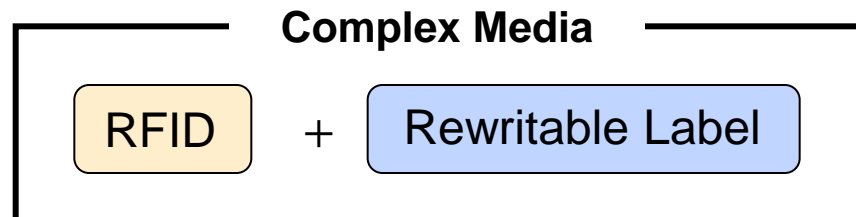- Automatic Control of Environment
- Home Security

RFID (WIRELESS IC TAG)-REWRITABLE COMPLEX MEDIA

RFID (Wireless IC Tag)

Advantage:
- noncontact
- information update

Problem:
- no visibility
- reader device required

Rewritable Label

① process of erasing rewrite label

② process of printing rewrite label

【thermal paper】
- protect layer
- heat recording layr
- substrate (synthetic paper etc)

Advantage:
- rewritable, visibility

Problem:
- contact printing
- existence of various rewriting types

● addition of visibility in RFID
● data backup
● partial display of information

Complex Media

RFID + Rewritable Label

REWRITABLE LABEL SYSTEM

Characters and Barcodes Rewritable System Developed in Japan

• 日

Rewriting Durability $\geqq$ **2000Times**

Thermal Erasing
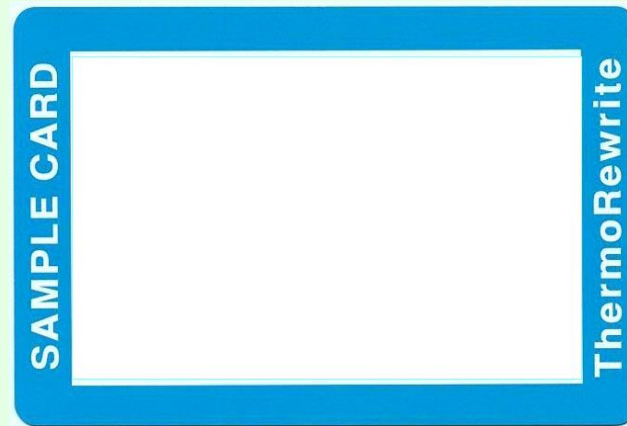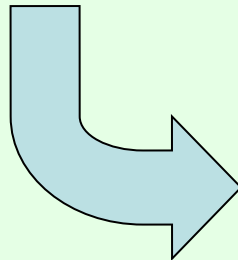
Thermal Printing

Rewritable Label
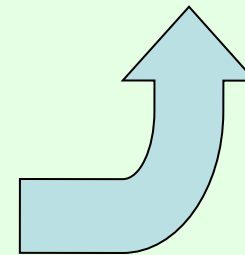
COLORATION AND COLORLESS PROCESS OF REWRITABLE FILM

Leuco Dye

Reversible Developer

Coloration (Amorphous)

Rapid Cooling

Heating

Colorless (Crystal)

Coloration (Melting)

Heating

Slow Cooling
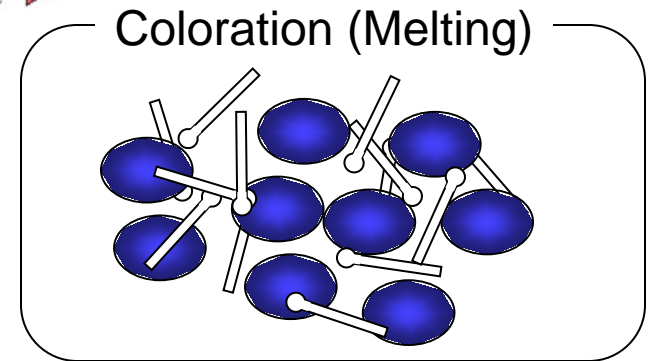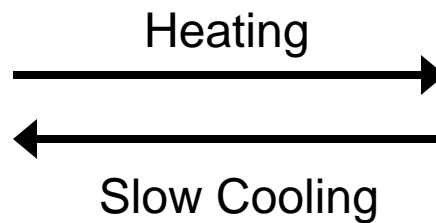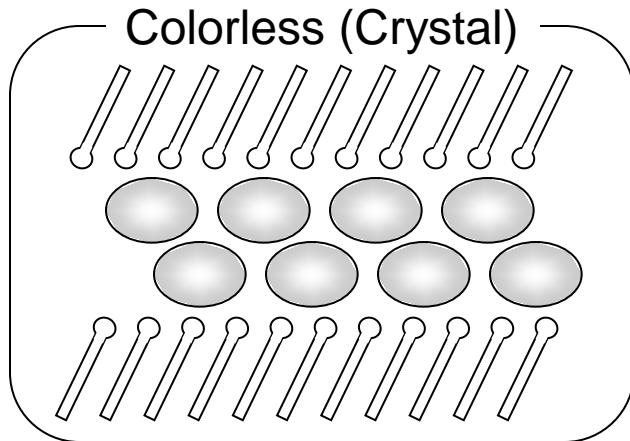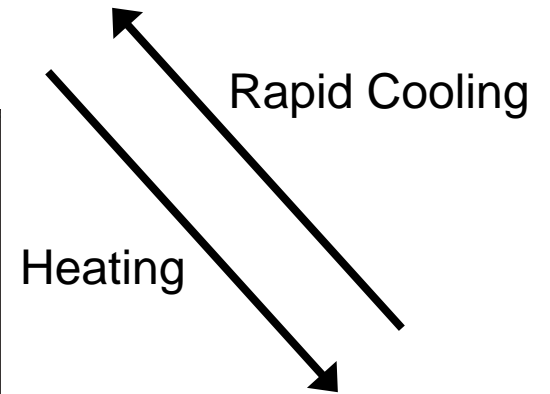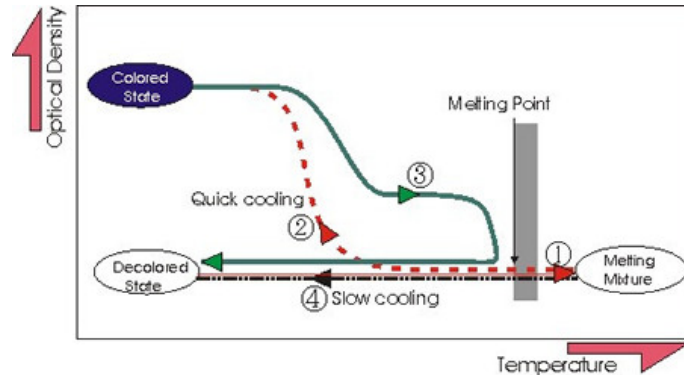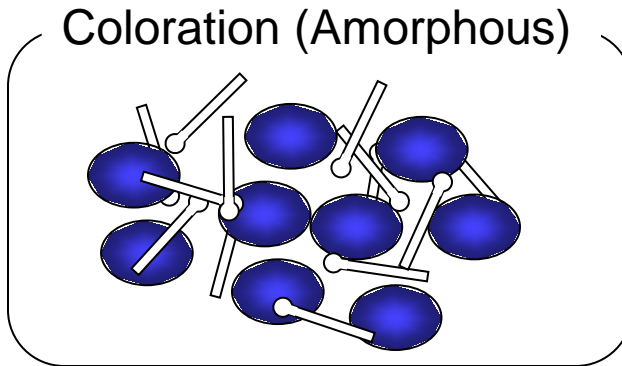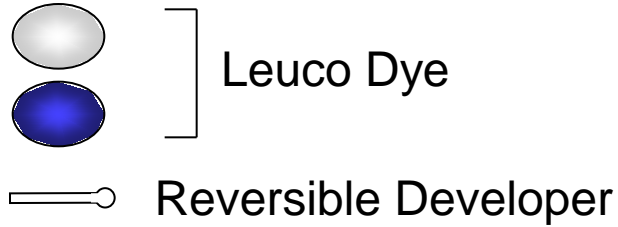
DISPLAY AND DIGITAL PAPER

Digital Paper

Display
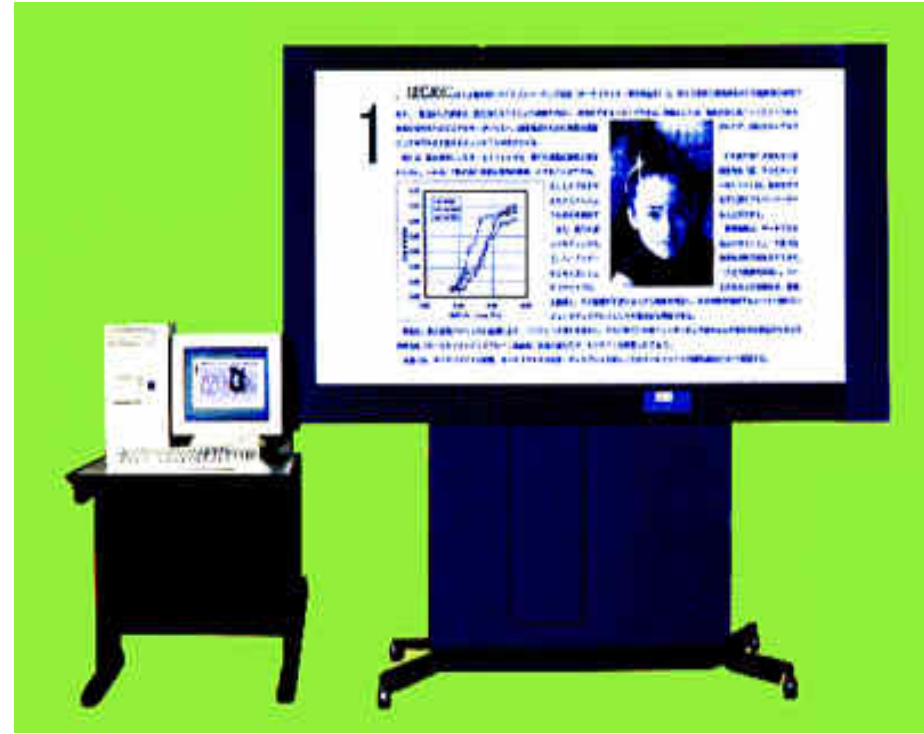
DEVELOPMENT OF RFID-REWITABLE COMPLEX MEDIUM AND ITS STANDARDIZATION

IC-chip

QR-cord

RFID Layer

Rewrite Label

Rewrite Sheet

RFID Layer
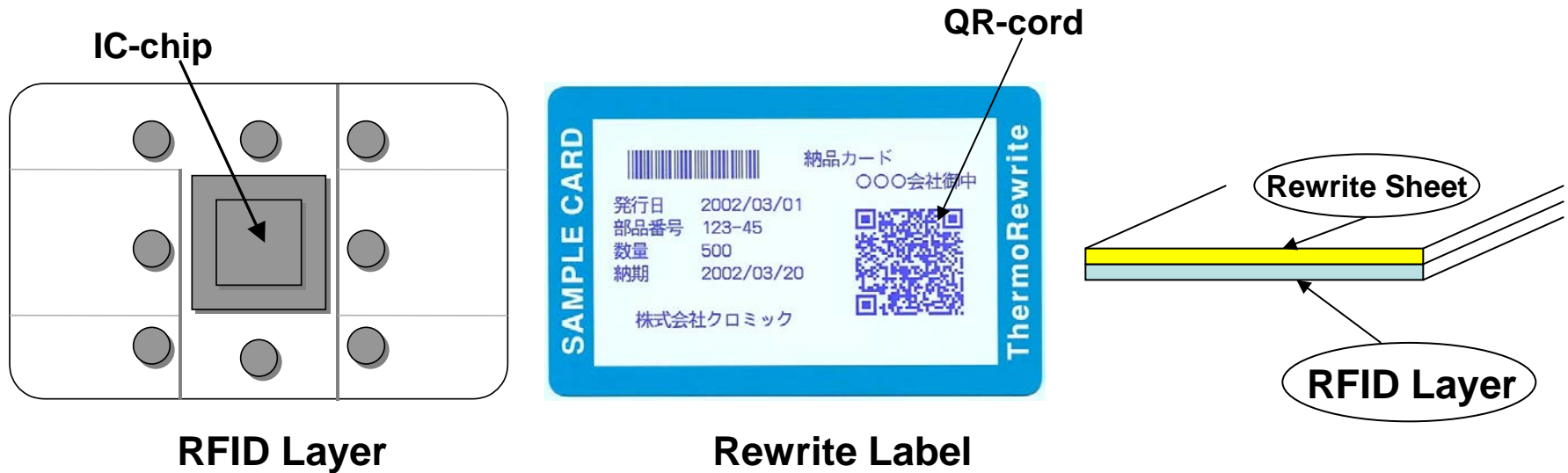
Standardization of the Complex Media

● Temperature Allowance

● Surface Roughness

● Verification and Characterization Methods
(impact strength, exfoliation strength etc.)

DEVELOPMENT OF NONCONTACT REWRITABLE SYSTEM

Conventional Technology

● Writing and Erasing
   by Contact Thermal Printer

● Rewriting Durability ≈ 300

Erasing Process

Writing Process

Protect layer
Rewritable recording layer
Base Film

New Technology

● Noncontact Writing and Erasing
   by Laser

● Rewriting Durability ≥ 3,000

Digital Paper

| reading optical system | CCD camera | | 2-D code decoding |

| xy movable mirror | writing optical system | YAG laser | vector data |

| erasing flash lamp | | print code decoding | network protocol |

~20cm

Protect Layer
Light-Heat Conversion Layer
Rewritable Recording Layer
Base film
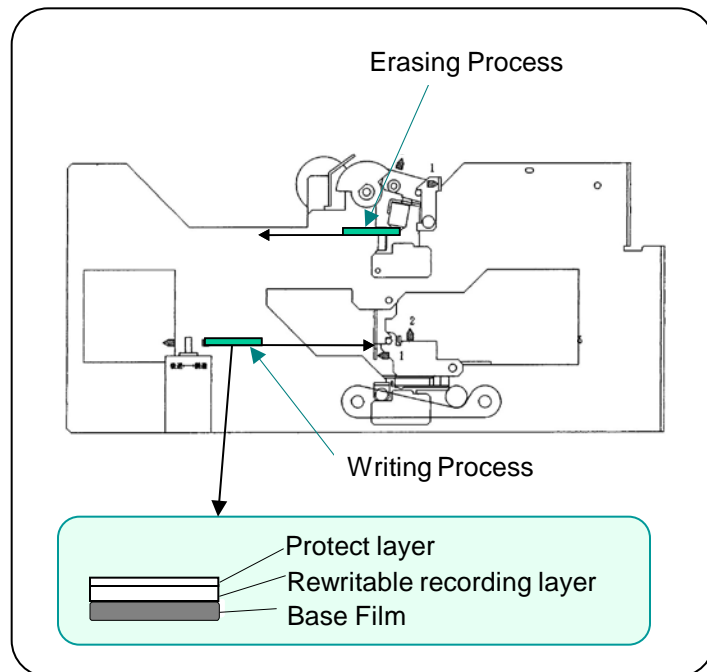
DEVELOPMENT OF NOVEL IR-ABSORBING DYE FOR EFFICIENT LIGHT-HEAT CONVERSION

● CD-R : Adsorption Change by Light Irradiation

Phthalocyanine Dye

● Cu Layer

| Cu layer |
| Leuco Dye |
| Substrate |
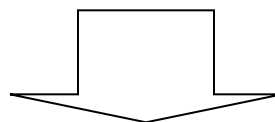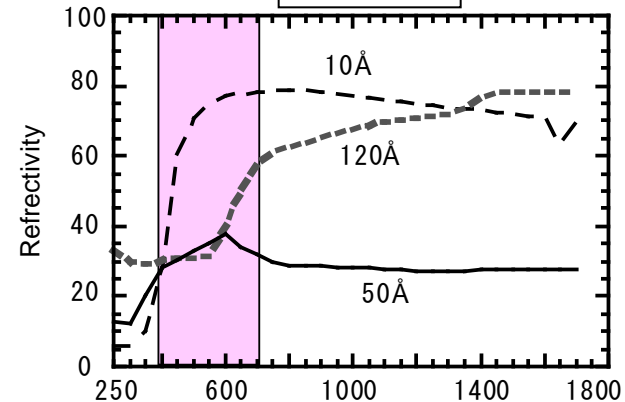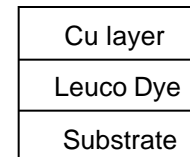
● Novel IR-Absorbing Dye Developed by RIKEN
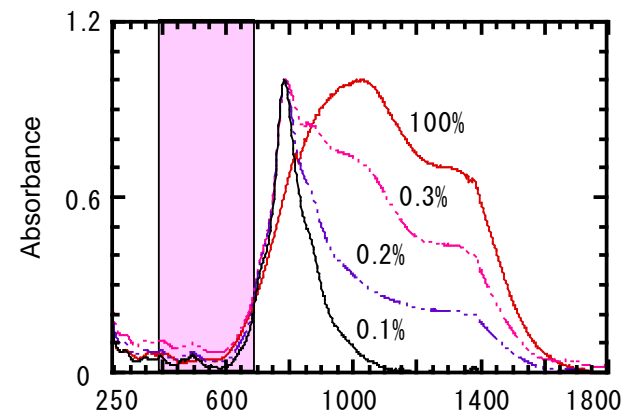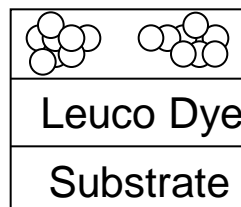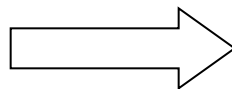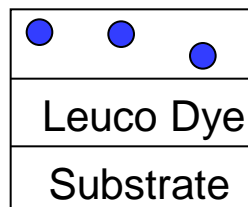
Rewritable Label System

Noncontact Printing

Using Rewritable Label

・Rewritable label

物流ラベル

東京駅前店

・No need of label peeling

Computer

Laser Marker

・Nocontact erasing using a laser beam

Computer

Laser Marker

・When you use seal labels, you need peel labels process.

LA-02

DEVELOPMENT OF NONCONTACT REWRITABLE SYSTEM

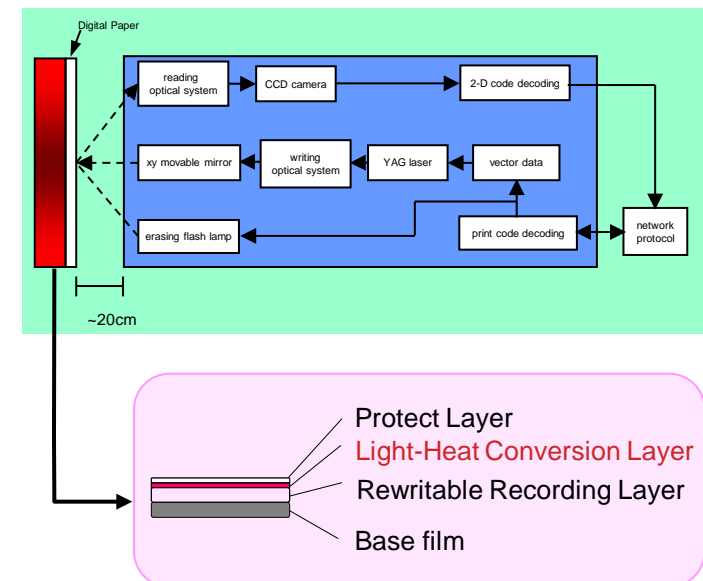## Conventional Technology

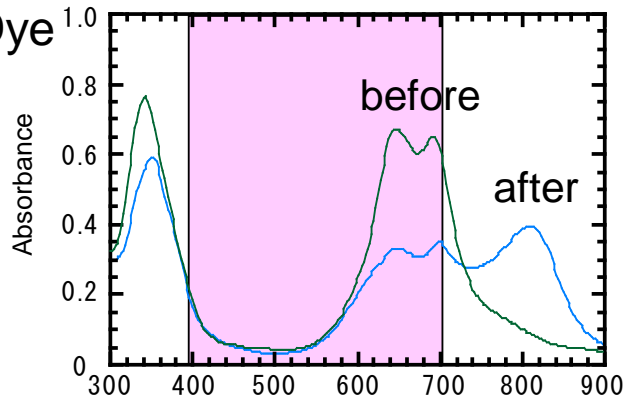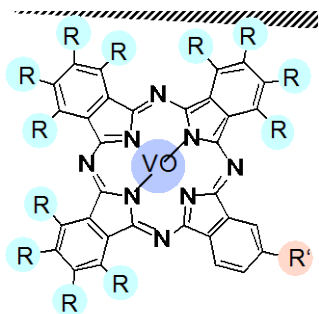- Writing and Erasing by Contact Thermal Printer

- Rewriting Durability ≈ 300

Erasing Process

Writing Process

Protect layer
Rewritable recording layer
Base Film

New Technology

- Noncontact Writing and Erasing by Laser

- Rewriting Durability ≥ 3,000

Digital Paper

reading optical system	CCD camera	2-D code decoding
xy movable mirror	writing optical system	YAG laser	vector data
erasing flash lamp	print code decoding	network protocol

~20cm

Protect Layer
Light-Heat Conversion Layer
Rewritable Recording Layer
Base film

Goals

- Writing Speed ≥ 2,000 mm/s
- High Contrast
- QR-codes Readable

- IR-Absorbing Dye for Light-Heat Conversion

Leuco Dye
Substrate → Leuco Dye
Substrate

- Principal of Thermochroism

thermal energy

colorless   coloring
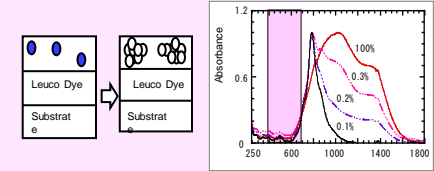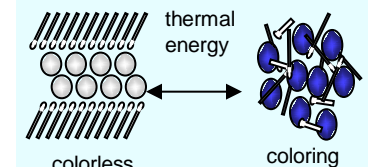
Technical Development

Improvement Flash Lamp Life Time
30,000 times ——— 1,000,000 times

Control of Writing
Readout → Feedback → Adjustment of Writing Laser Power

FEATURES OF THE NEW SCM AND ITS PROFITS

Features of the New Supply Chain Management (SCM)

Using Rewritable Labels

・Rewritable label

・No need of label peeling

・Nocontact erasing using a laser beam

物流ラベル

東京駅前店

Computer

Laser Marker

Computer

Laser Marker
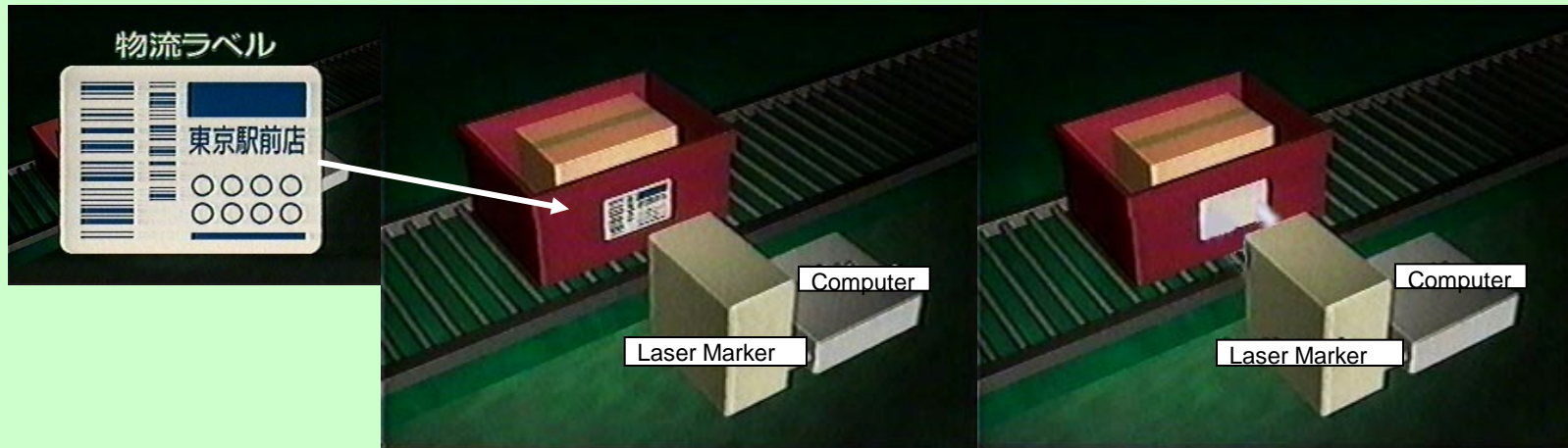
・When you use seal labels, you need peel labels process.
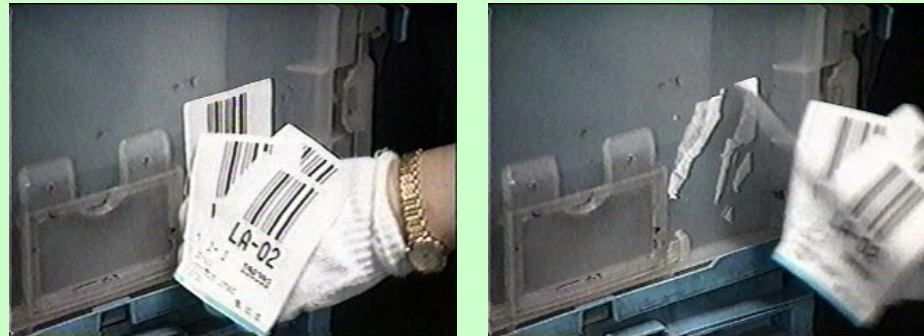
FEATURES OF THE NEW SCM AND ITS PROFITS

Profits of Introducing This SCM

Manufacturers' Profits:

- ● Cost Saving with Invoice-less

- ● Omittiing of Labeling Process

- ● Cost Saving of Purchasing Labels by Reusing Rewritable Tags

- ● Reduction of Office Work

FEATURES OF THE NEW SCM AND ITS PROFITS

Retailers' Profits:

- Reduction of Inspecting Operation
  (Skipping of Packing List Inspection)
- Saving of Personnel Costs by Reduction of Inspection Operation

In the Future:

- Realization of No-inspection
- Realization of True Invoice-less System

Logistics Centers' Profits:

- Improvement of Inspection Accuracy
- Quality Control
- Reduction of Office Work
- Skipping of Label Peeling Process

Other Profits:

Wastes Reduction of Corrugated Boxes

TAG AND RFID

RFID

Logistics and Factory Management

ACCESS CONTROL APPLICATIONS

Ski Pass

Ski PASS

CODE:0588-458-AF-13
5 Hours Ticket
10:00-15:00

31,12,2001

Vister Badge

VARIANT DATA TECHNOLOGY

Welcome to

Name: Thomas Wise
Position: Visiting scientist
Term: March 5 2002
to April 6 2002

ID CARD APPLICATION

Student Card

Loyalty Card

Patient Card

STANDARDIZATION OF RFID (WIRELESS IC TAG)-REWRITABLE COMPLEX MEDIA

● Comparison with existing technology, research and development, and standardization

RFID (Wireless IC Tag)

Advantage:
・noncontact
・information update

Problem:
・no visibility
・reader device required

● addition of visibility in RFID
● data backup
● partial display of information

Complex Media

Rewritable Label

① process of erasing rewrite label

② process of printing rewrite label

【thermal paper】
protect layer
heat recording layr
substrate (synthetic paper etc)

Advantage: ・rewritable, visibility
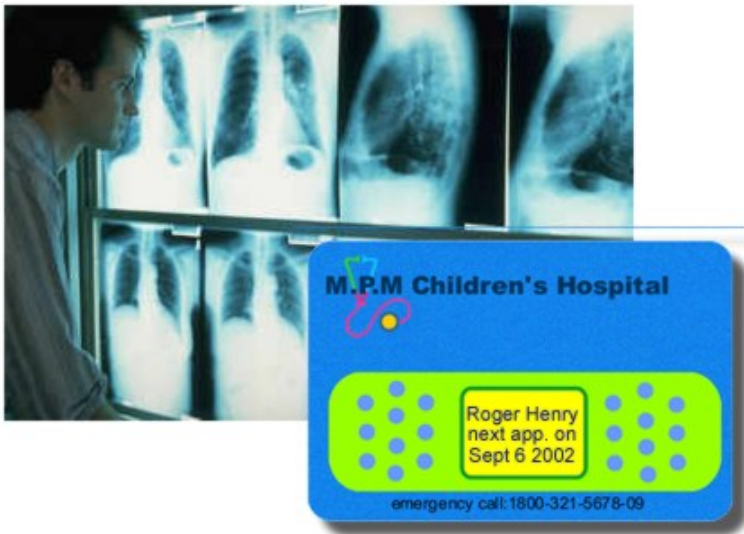
Problem:
・contact printing
・existence of various rewriting types

Technical Committee

Consensus on a draft agreement

Draft International Standard (DIS) to ISO's Mmbership

ISO commission TC104 / EC122
17363WD, 17364WD, 17365WD

current situation

● Incompatibility of rewriting devices

● Contact printing (ex. Suica)

standardization

● Standardization of RFID-Rewritable Complex Media

● surface roughness
● absorbity
● temperature allowance of fabrication
● varification and charactrization methods etc.

Noncontact Printing

Digital Paper

reading optical system — CCD camera — D code decodine
movable mirr — writing optical system — YAG laser — vector data
erasing flash lamp — print code decodine — network protocol

~20cm

Protect Layer
Light-Heat Conversion Layer
Rewritable Recording Layer
Base film

R F I D +

● IR-Absorbing Dye for Light-Heat Conversion

Leuco Dye / Substrate → Leuco Dye / Substrate

100%
0.3%
0.2%
0.1%

Absorbance
250 500 1000 1400 1800

● Molecular behavior of coloration/colorless

Leuco Dye
Reversible Developer

Colorless (Crystal) ←→ Coloration (Melting)

thermal energy

RIKEN (Wada)