



# Aluminum Electrolytic Capacitor 电解电容器

代理商：广州荣肯电子科技有限公司

# Hitachi AIC Company Profile

## 日立AIC公司简介

Factory 工厂

Sales Office 营业部

Cap. 3Main Works  
P.Board 3Main Works

Boston AIC

HPC-Distribution

Hong Kong AIC

Singapore AIC

- Annual Net Sales 年净销额 400Million US\$(50Billion JPY)
- Employees 雇员 1097 ( about 2000 )

### Products and Sale 产品和销售

Capacitor 电容器 45%

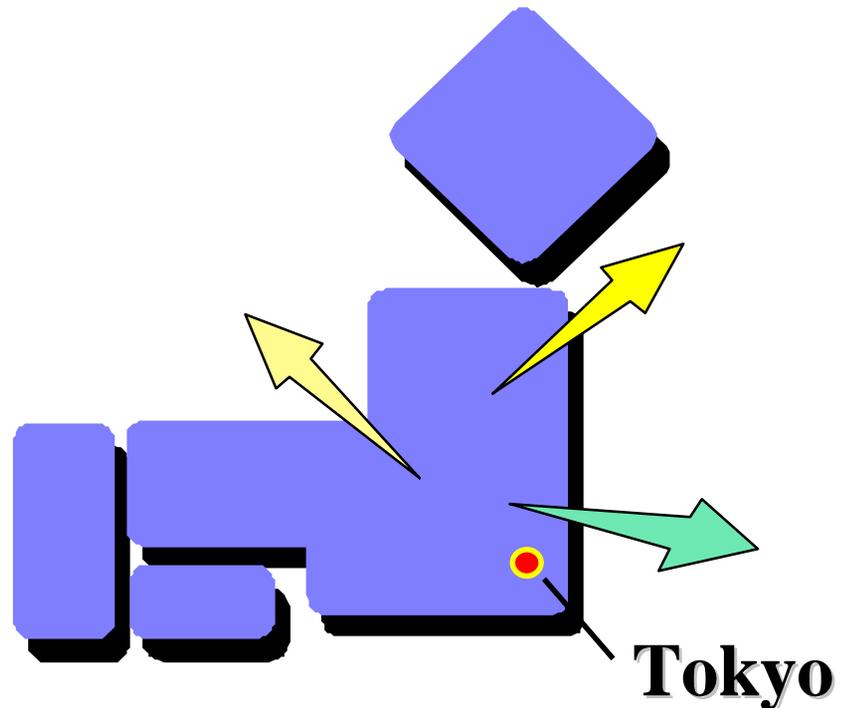
Printed Circuit Board 印刷电路板 50%

Other 其它 5%

# Products and Sale 产品和销售 (Capacitor 电容器)

<b>Aluminum</b> 铝电解电容(Haga works)	<b>28 Million US\$</b>	<b>39%</b>
<b>Tantalum</b> 钽电容	<b>35</b>	<b>49</b>
<b>Film</b> 薄膜电容	<b>9</b>	<b>12</b>
<b>Total</b>	<b>72</b>	<b>100</b>

(January-June, 2001)



# Production Organization 生产机构

**Material Factory**  
原材料工厂

**Kamioka works**  
神冈工厂

**Ichihara works**  
市原工厂

**JHC**



**Assembly Factory**  
装配工厂

**Haga works**  
芳贺工厂



**Tokyo**

# Hitachi AIC Inc.

## Haga Works

## 日立AIC芳贺工厂

**ISO9000**    **ISO14000**  
**JUL. 1996**    **MAY.1998**

ISO—国際品質保証規格登録取得



QS REGISTERED FIRM

JCQA-0152



EMS REGISTERED FIRM

JCQA-E-019



# Applications of Aluminum Electrolytic Capacitors

## 铝电解电容的应用



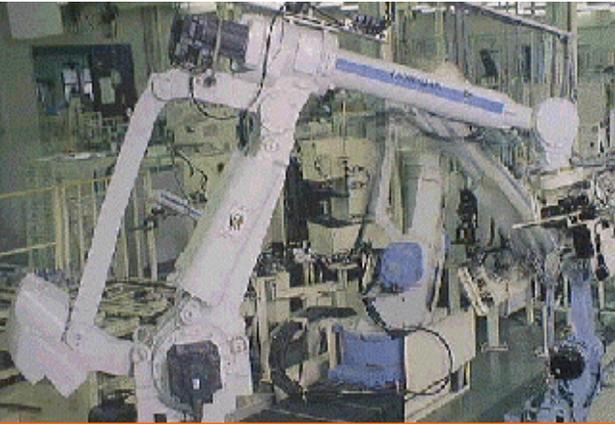
**Photo Flash**



**S. P. S. for Personal Computer**



**Switching Power Supply**



**Robot**



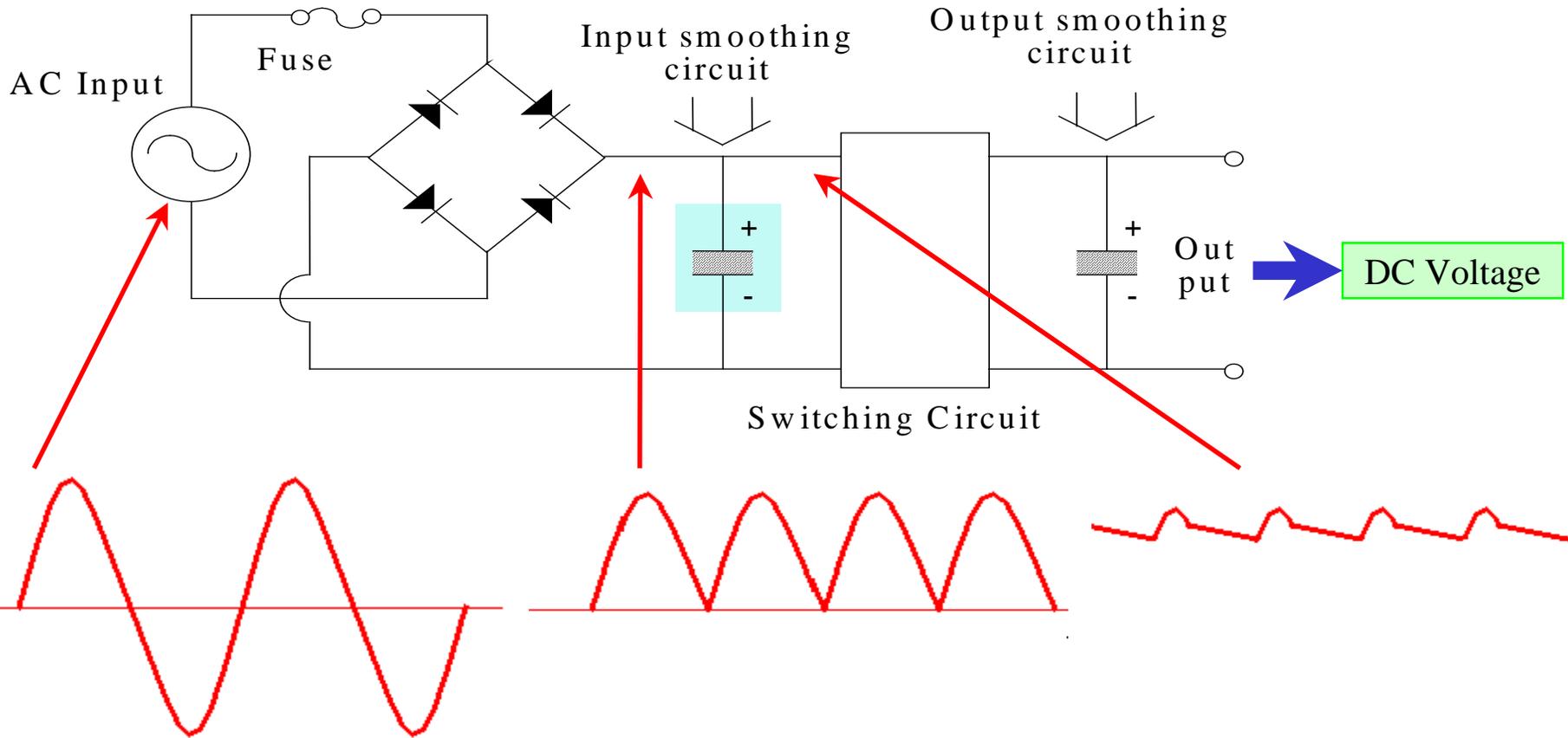
**Inverters**



**Inverter for Train**

# Application Diagram 应用示图

[Functions at initial stage of SW power supply]



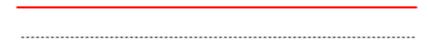
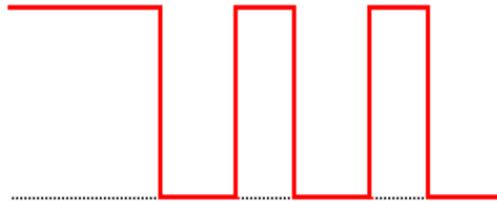
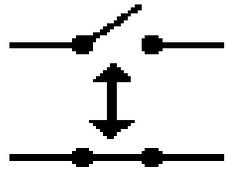
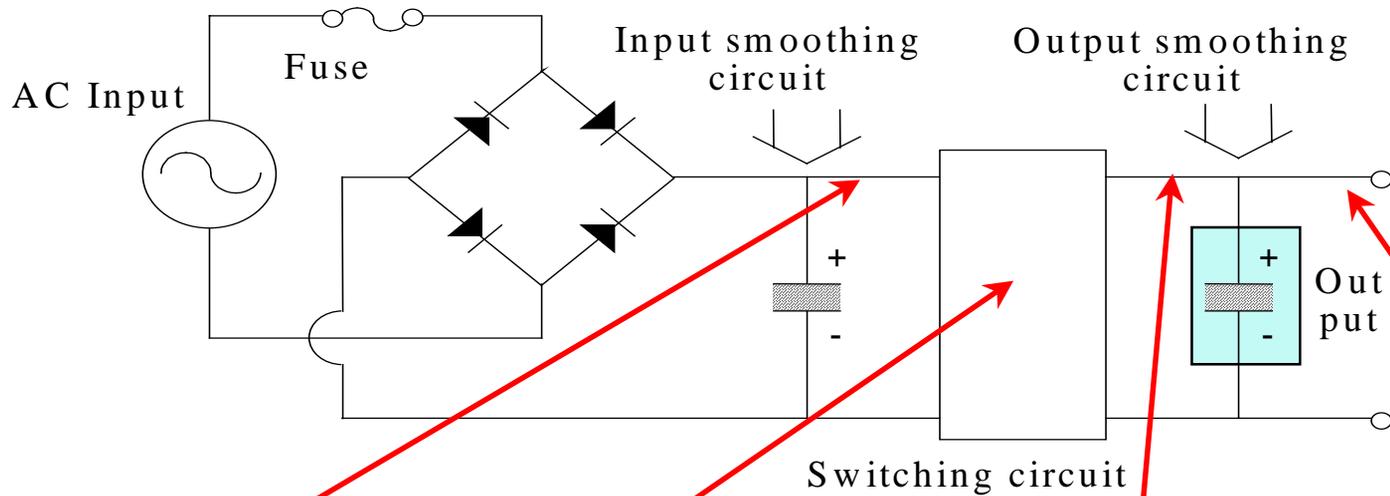
AC Voltage

Trancemission-wave  
rectification form

rectification form

# Application Diagram 应用示图

[Functions at second stage of SW power supply]



Switching

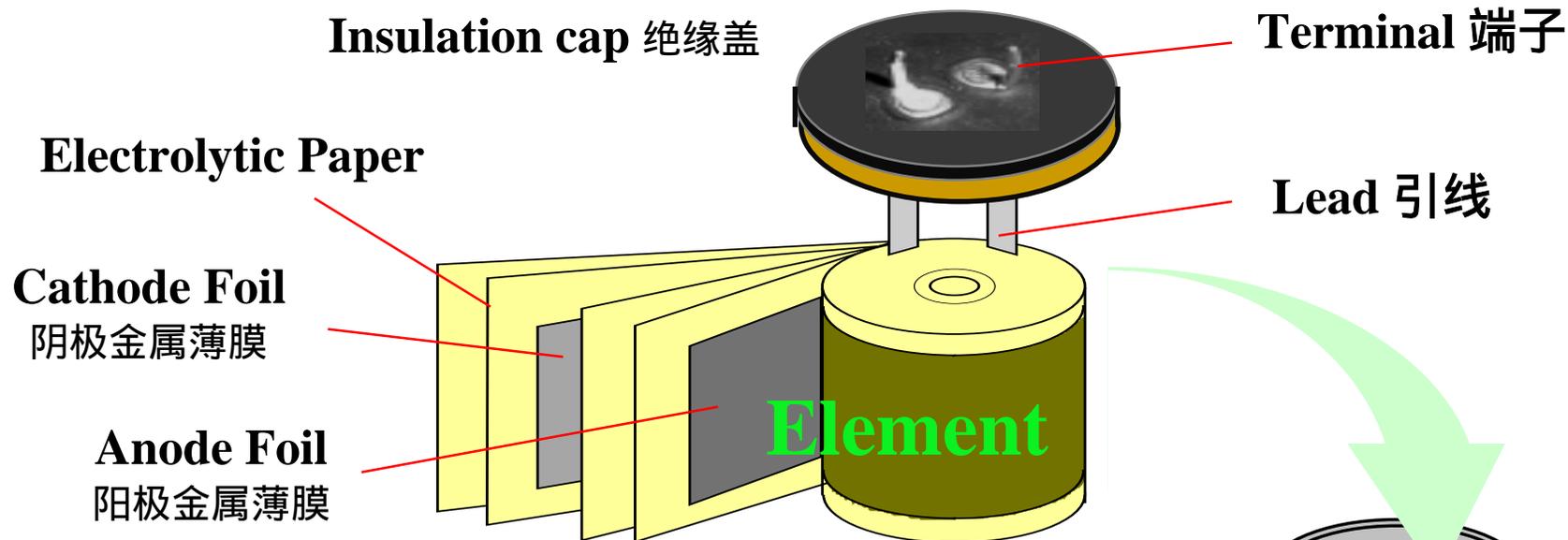
rectification form

Wave form after switching

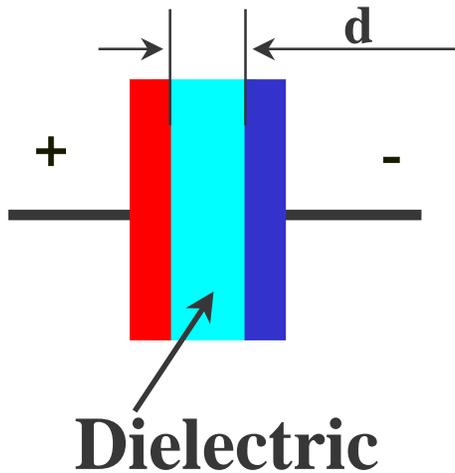
DC Voltage

# Construction of Aluminum Electrolytic Capacitors

## 铝电解电容的结构

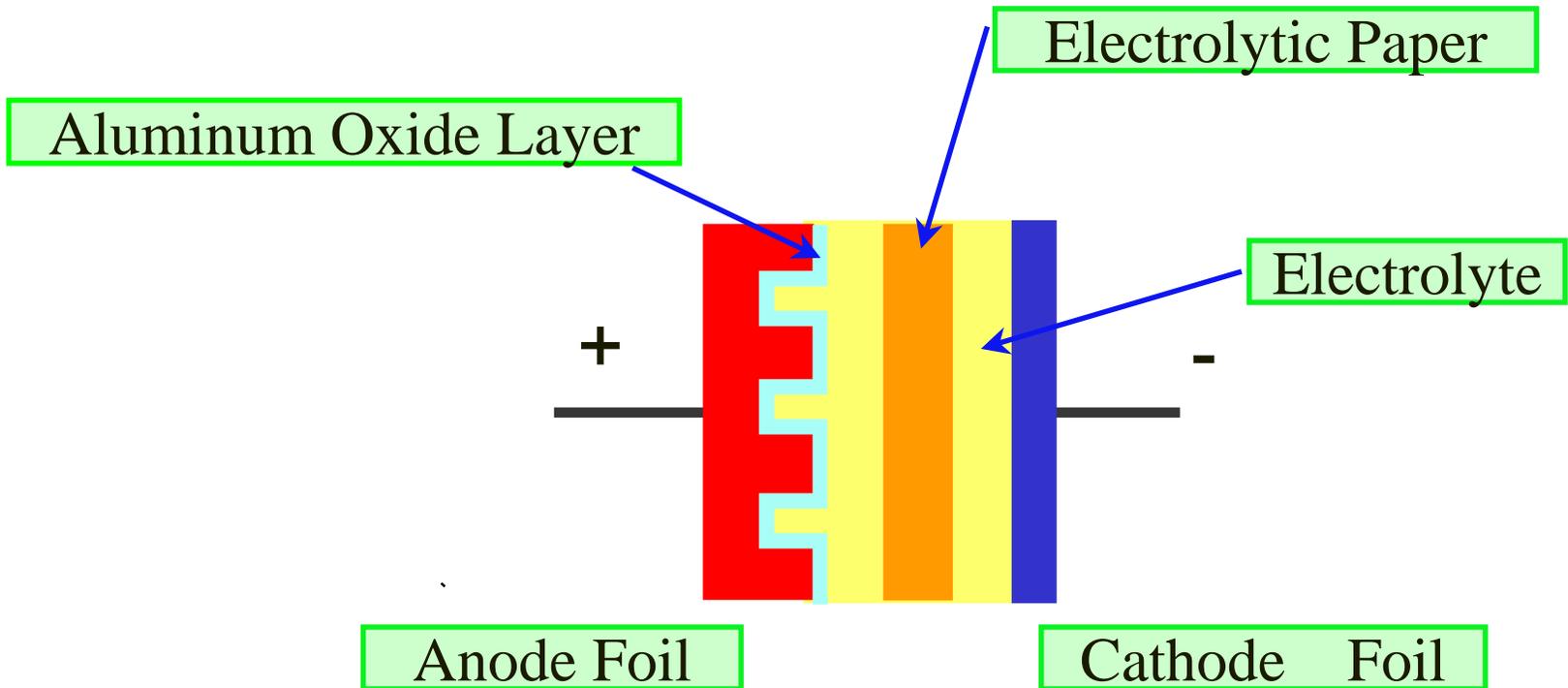


# Basic Structure 基本结构



$$C = \epsilon \cdot S/d = \epsilon_0 \cdot \epsilon_r \cdot S/d$$

$\epsilon_r$  : Proportional dielectric constant  
 $\epsilon_0$  : Dielectric constant in a vacuum  
 $d$  : Distance between electrodes  
 $S$  : Electrode area



# Manufacturing process 生产流程

## Material Factory

1. Etching

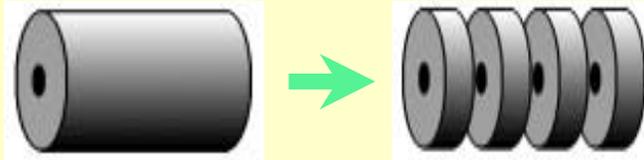


2. Anodization

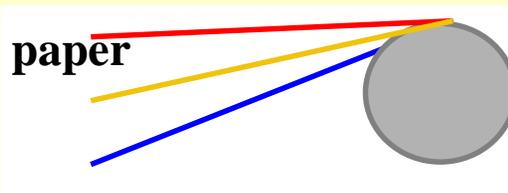


## Haga Factory(assembly)

3. Slitting



4. Winding



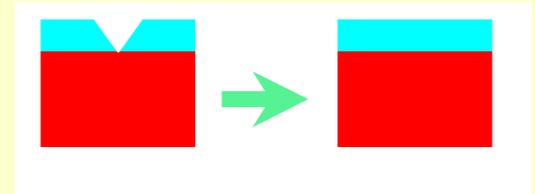
5. Impregnation



6. Assembling



7. Aging



8. Covering

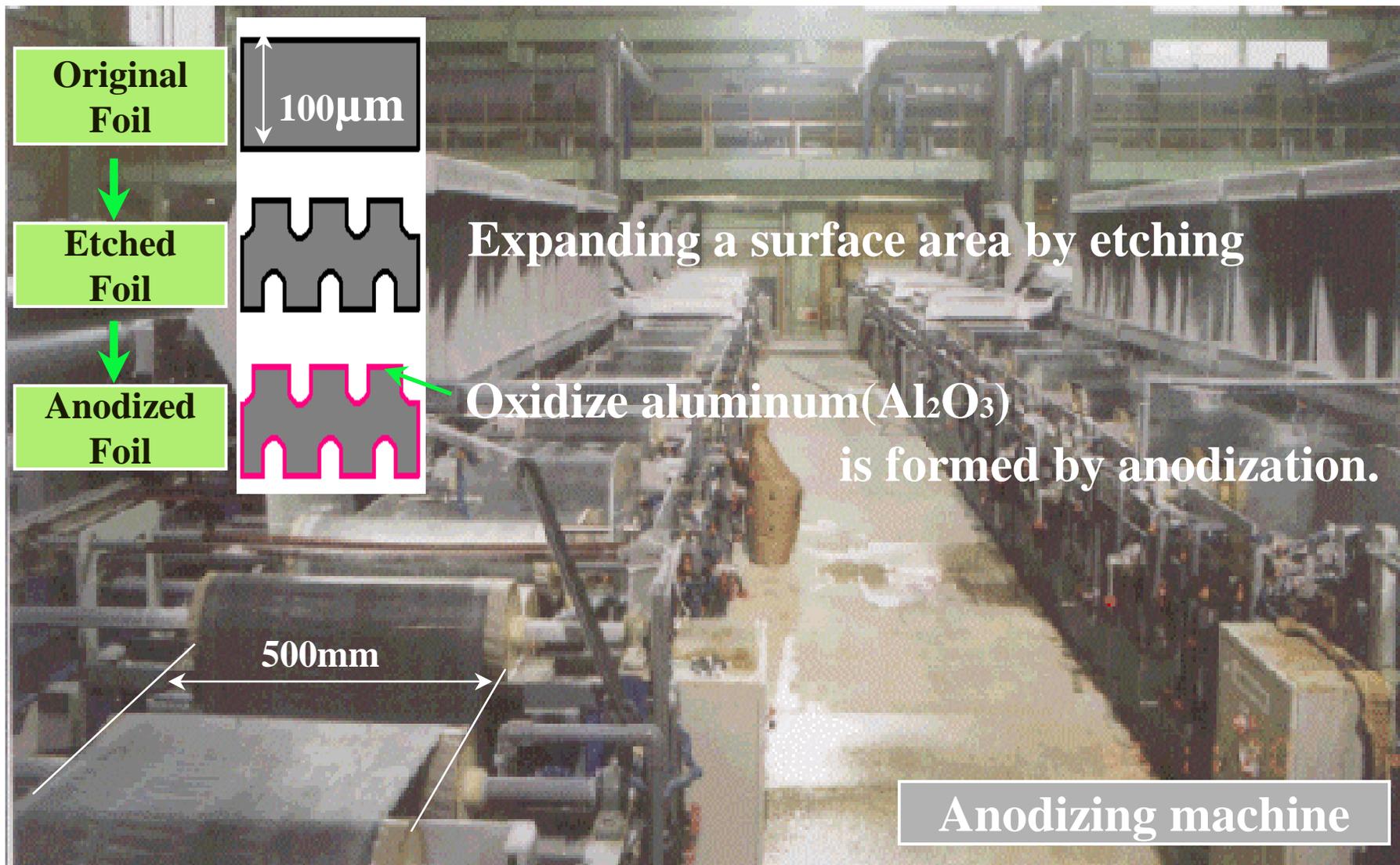


9. Piece by piece check

10. Final inspection

11. Packaging shipment

# Production of Anode Foils 生产阳极箔



# Etching 蚀刻

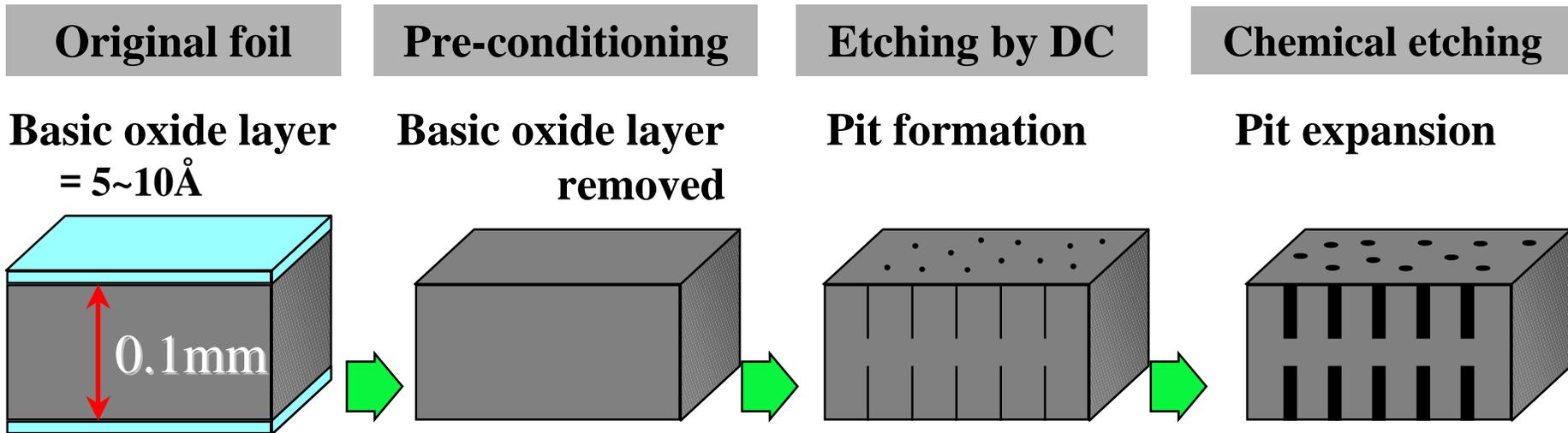
**Process to expand a surface area of aluminum foil.**

High purified aluminum foils

Taking away Basic oxide layer

Electrical treatment.

Treatment by aqueous chloride solutions Thus.



about 50 to 100 times surface area for low voltage type, about 10 to 40 times for high voltage type.

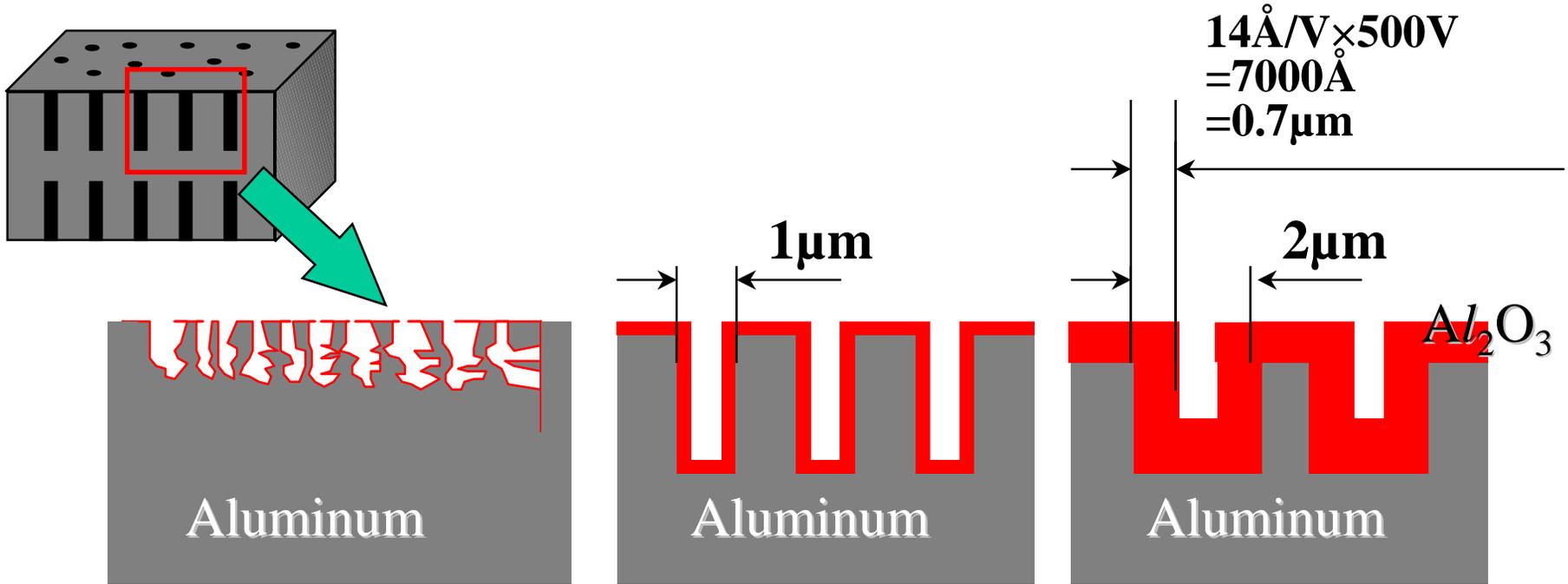
# Anodization 阳极氧化

Process to form the dielectric formation( $Al_2O_3$ ).

Etched foils are put into ammonium borate liquid.

Loading the voltage continuously

at around 100 to 200% rated voltage.



Low voltage  
(sponge type)

Middle voltage  
(pit type)

High voltage  
(pit type)

# Picture of Anode foil by S.E.M.

Cross section

100 $\mu$ m

$\times 400$

Surface

$\times 1000$

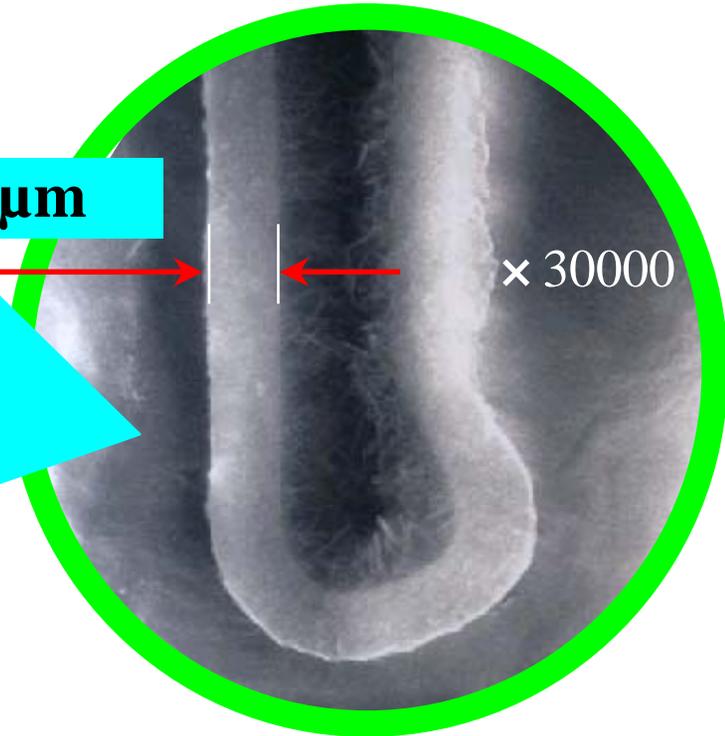
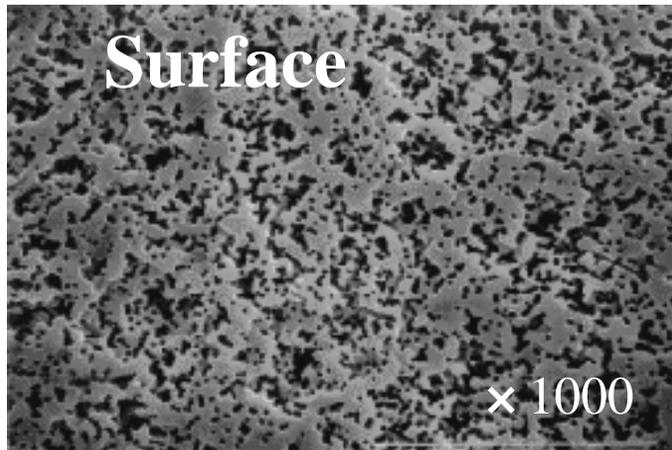
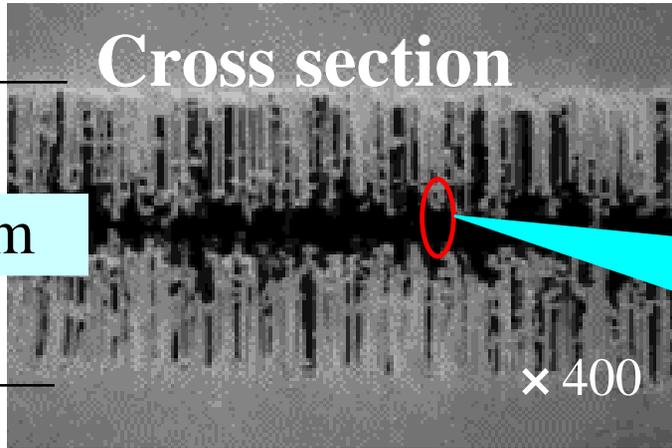
0.3 $\mu$ m

$\times 30000$

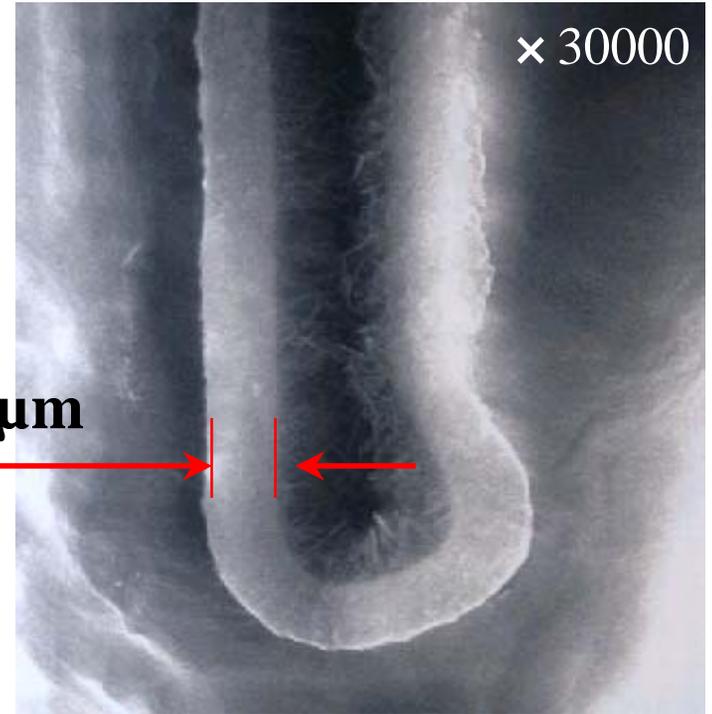
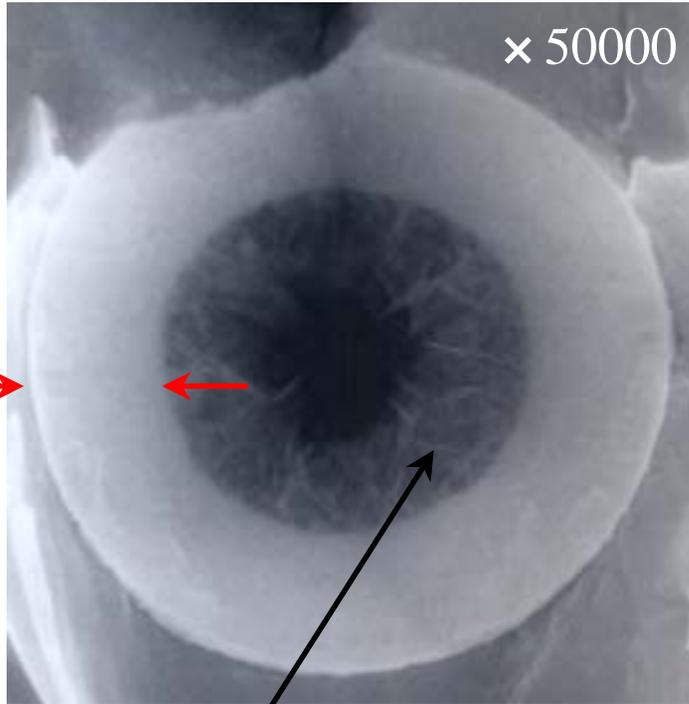
Pit

Al

Al<sub>2</sub>O<sub>3</sub>

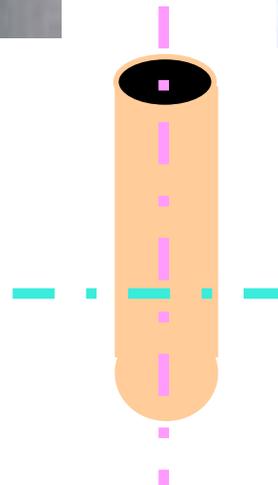
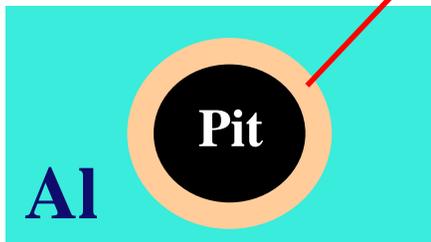


# Picture of Anode oxide film by S.E.M.

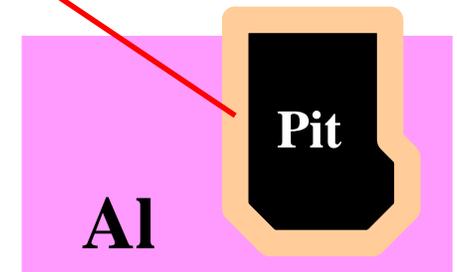


$\text{Al}_2\text{O}_3 \cdot n\text{H}_2\text{O}$

$\text{Al}_2\text{O}_3$

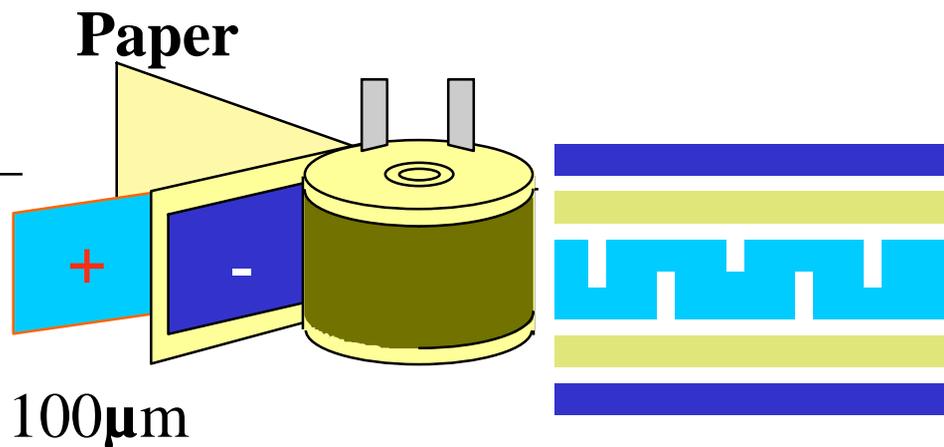
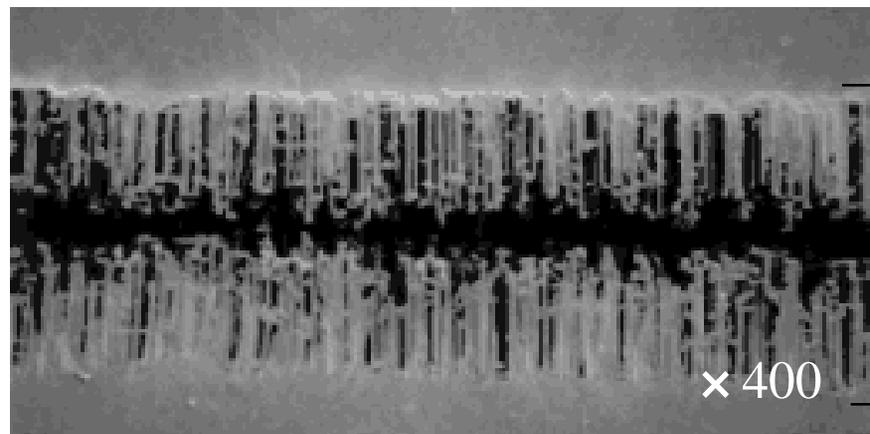


$\text{Al}_2\text{O}_3$

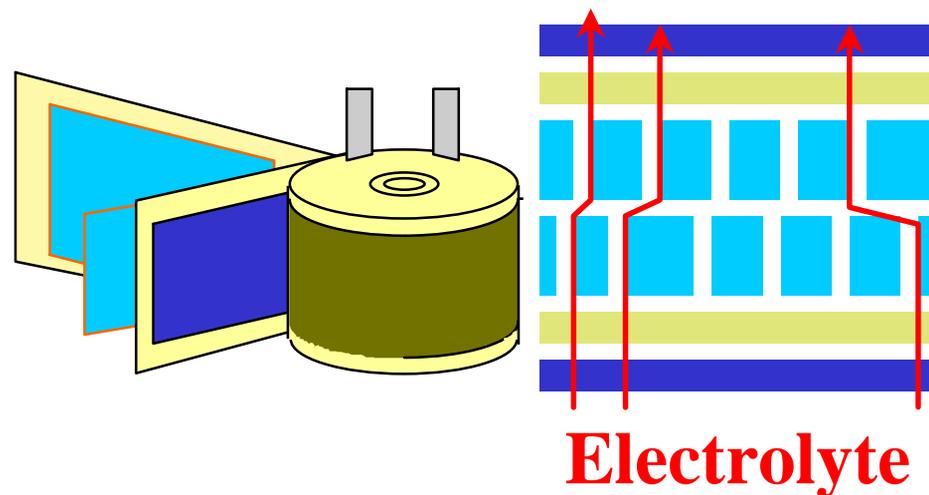
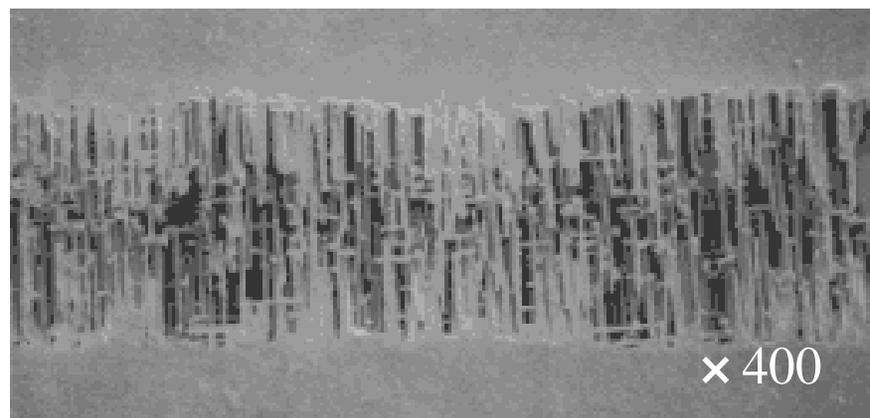


# Picture of Anode foil by S.E.M.

for single anode



for double anode

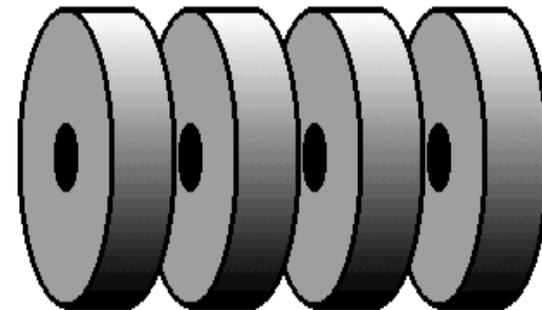
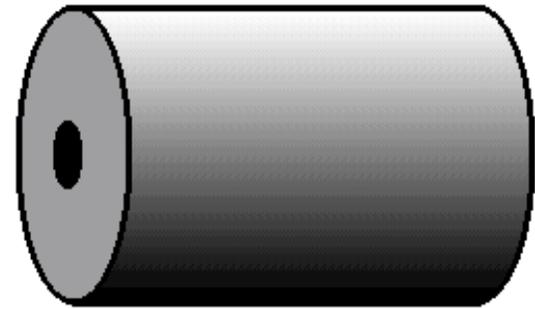


# Slitting 分割

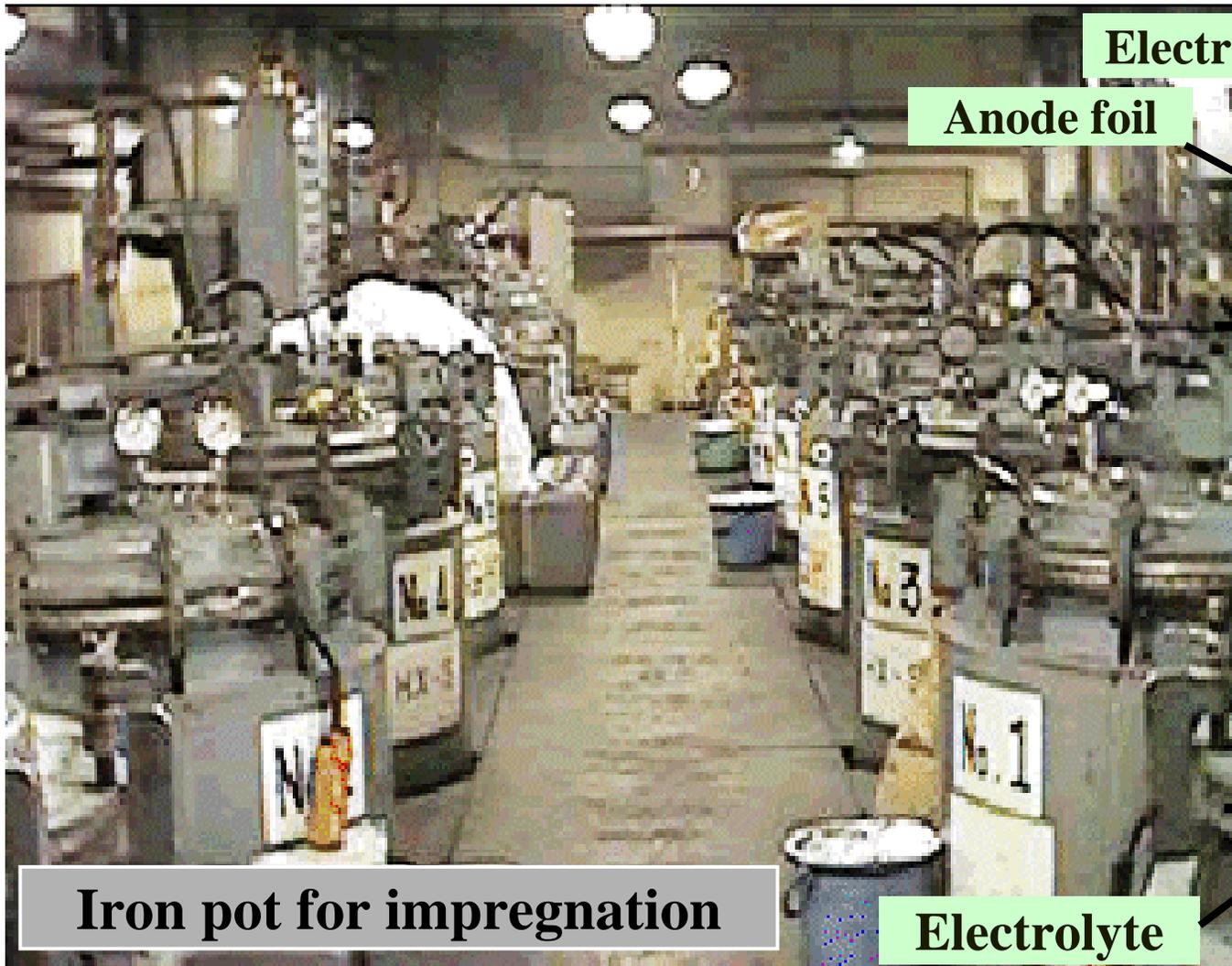
Aluminum foils and separator papers are cut, according to the capacitor element designs.



Slitting machine



# Impregnation 注入



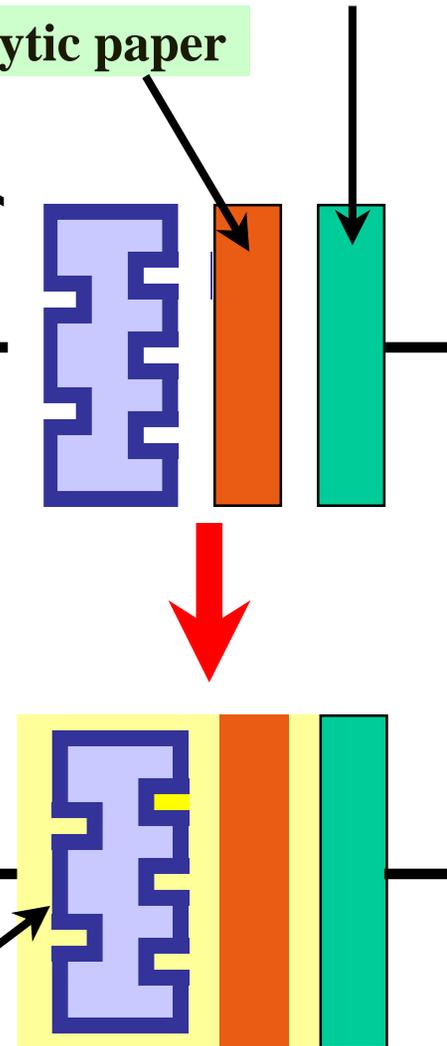
Iron pot for impregnation

Anode foil

Electrolytic paper

Cathode foil

Electrolyte



Process to soak the element with electrolyte.

# Assembly (1) 装配

After making holes on lead  
Insulation cap are connected to lead .

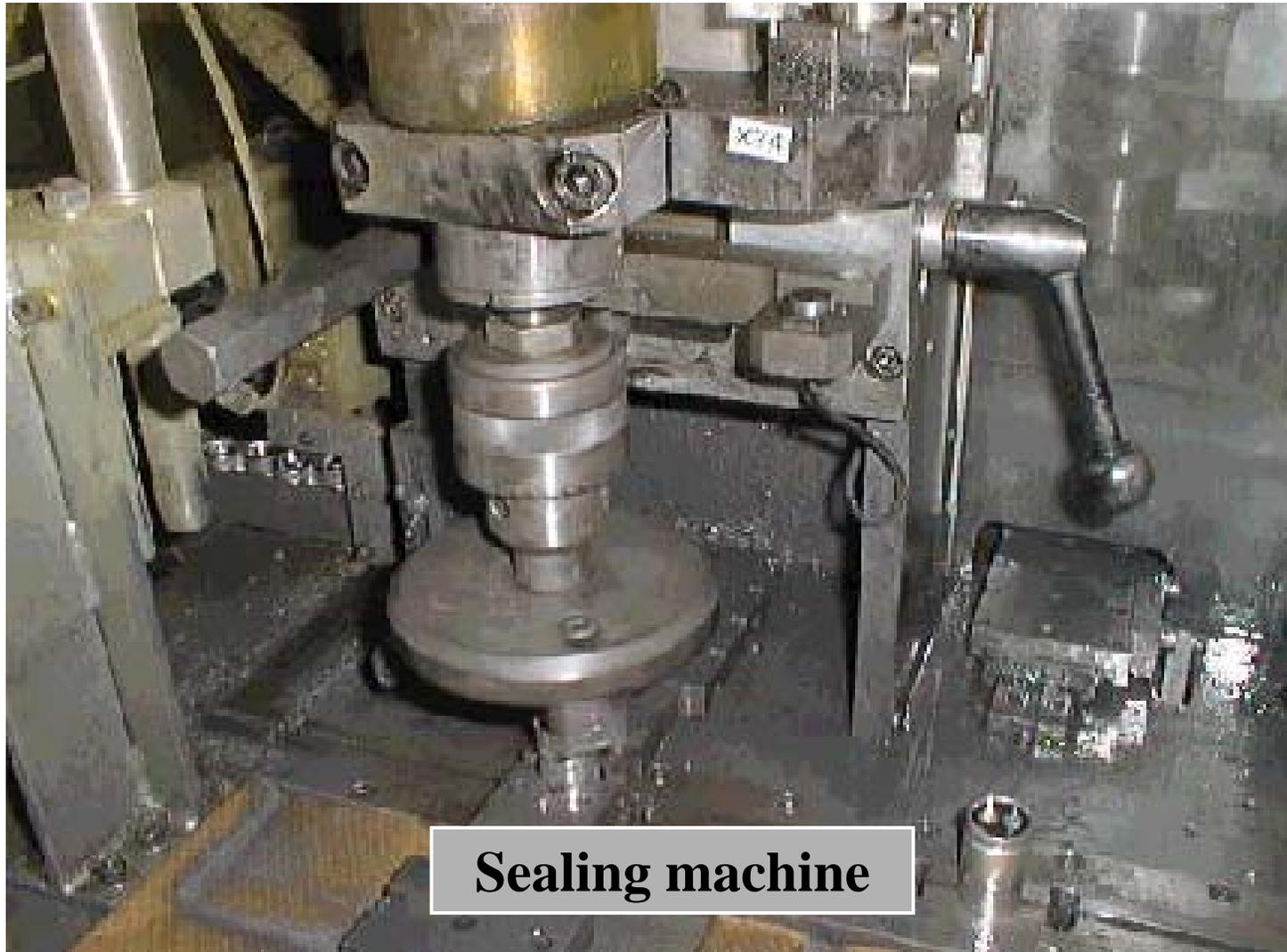


Assembly machine



# Assembly(2) 装配

The element is put into aluminum case.  
The brim of case is curled to seal.



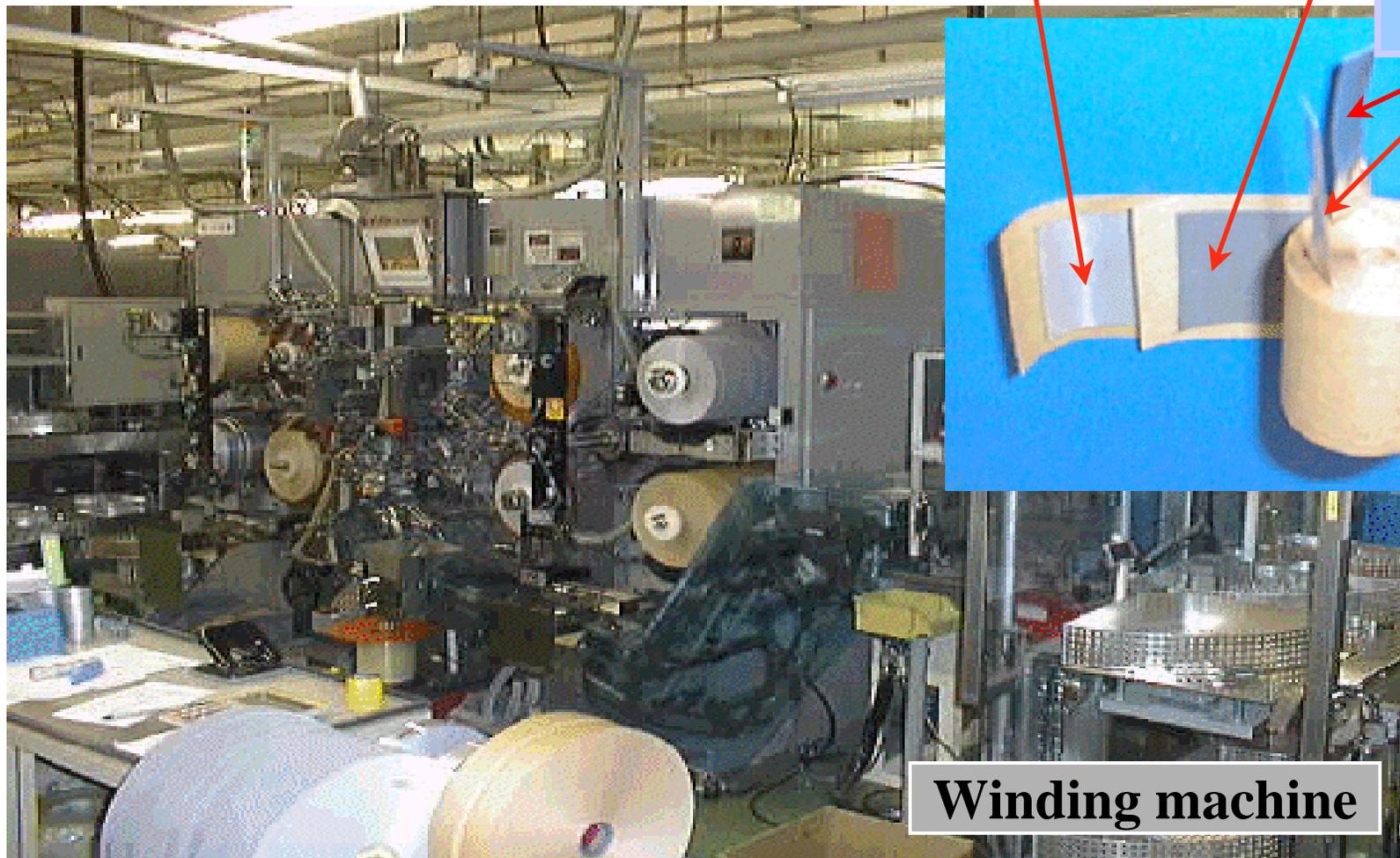
# Aging 老化



Aging machine

**Process to repair the formation damaged  
by cutting foil and winding foil.**

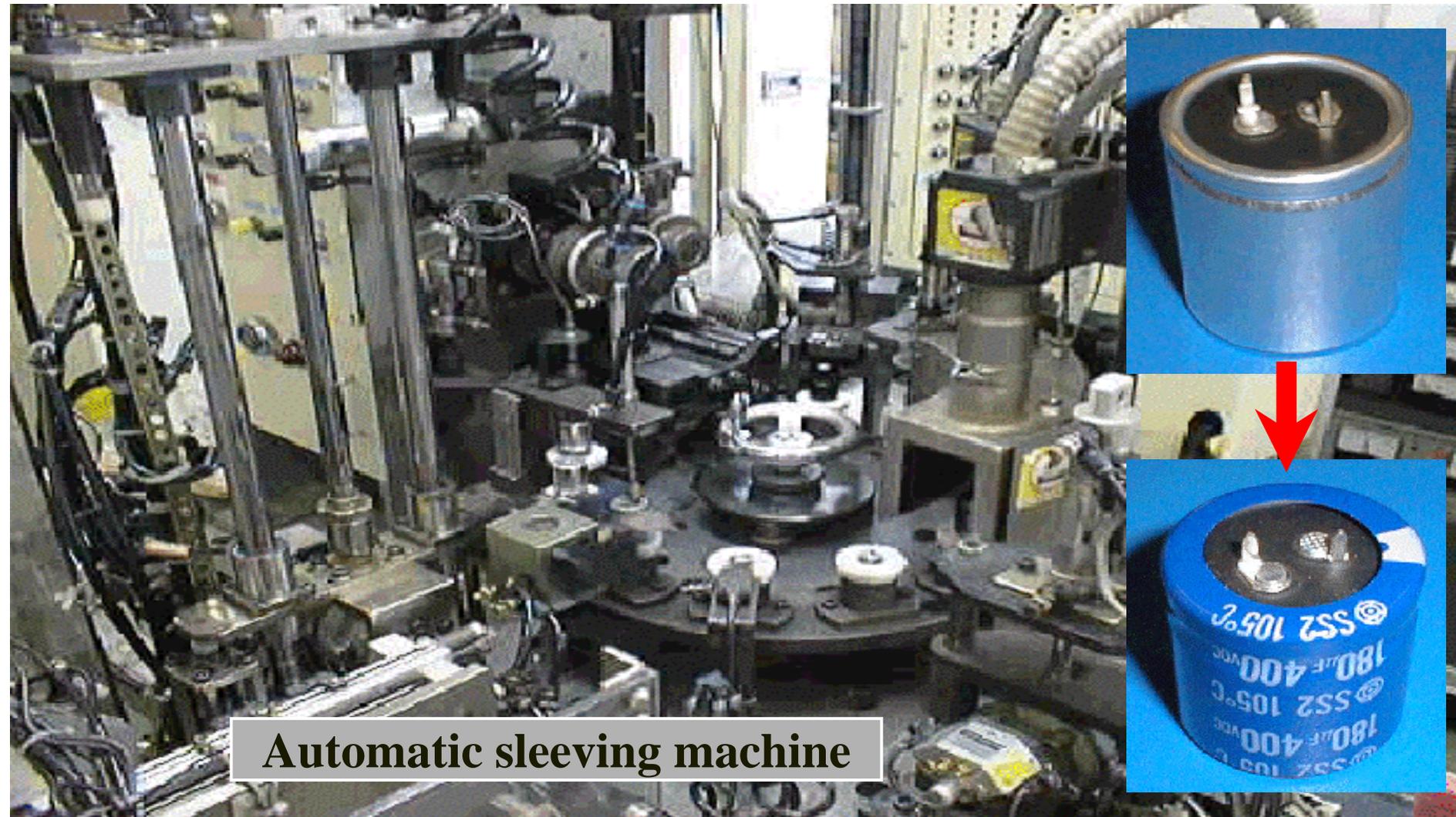
# Winding 圈绕



- Electrolytic papers are inserted between anode foils and cathode foils.
- They are wound in a cylindrical shape.
- Aluminum lead are connected to the element.

# Sleeving 套管

Process to print the product name,  
item code and lot number on the cover.



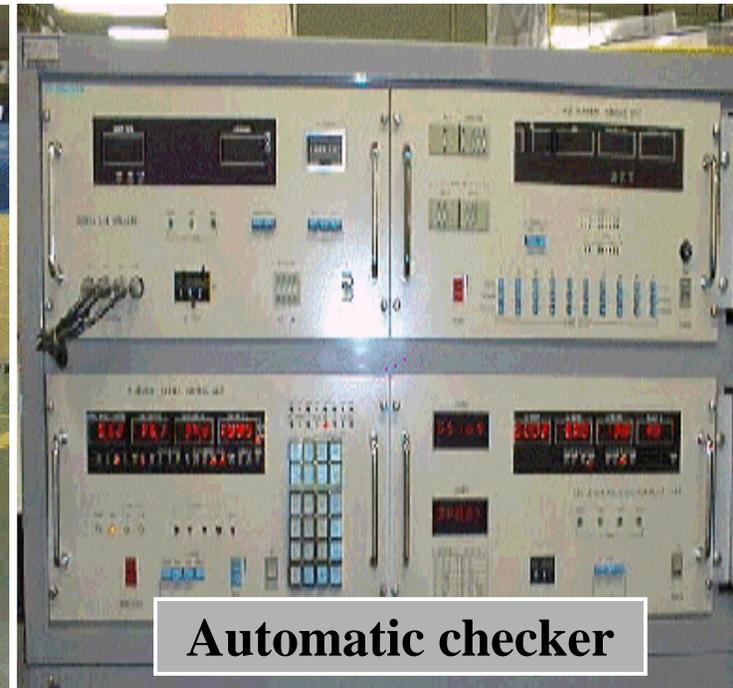
Automatic sleeving machine

# Piece by piece inspection

## 逐一检测



Outlook of checker



Automatic checker

Electrical characteristic and appearances are examined piece by piece.  
电器特性和外观逐一检测

# Packaging 包装

- The products are packaged. 产品包装
- Appearances are examined. 外观检查

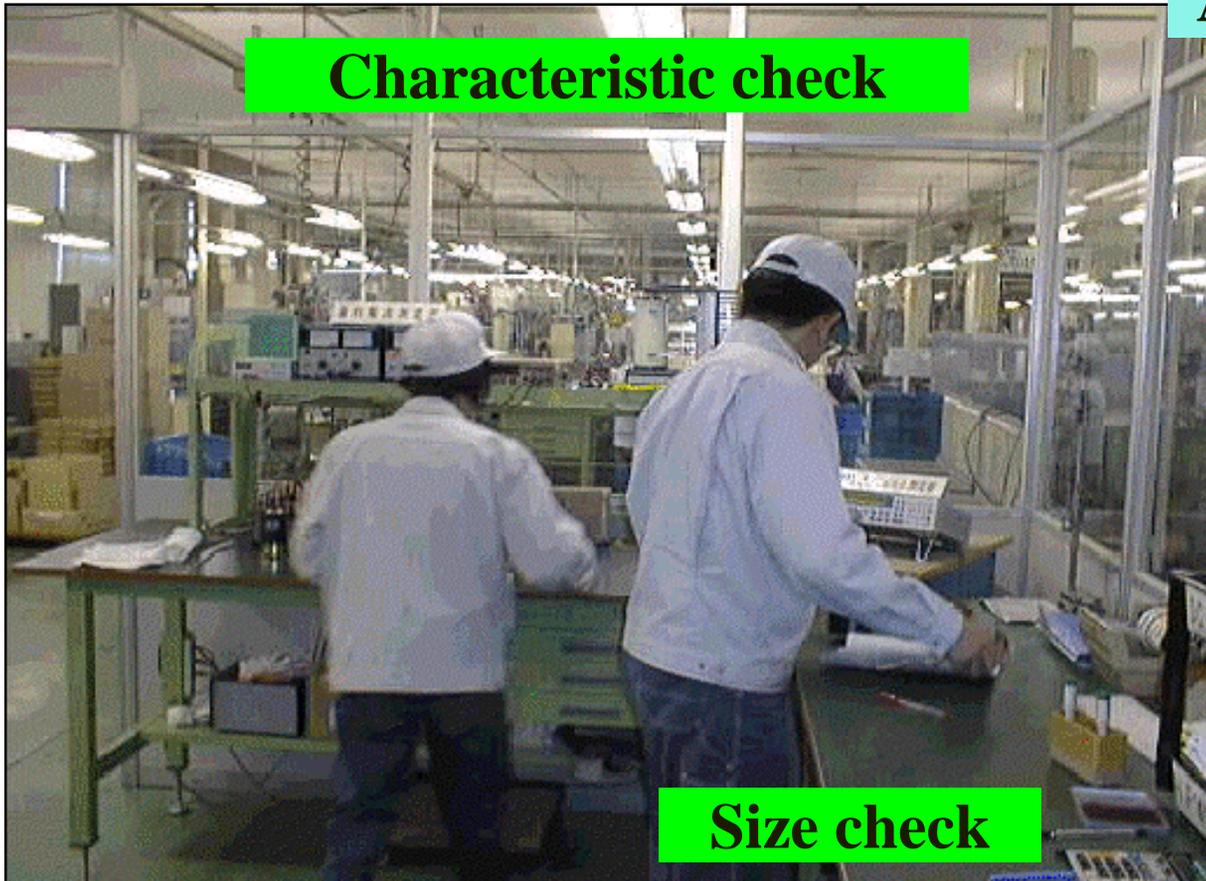


**Automatic packaging machine**

# Final inspection 最后检查

Sampling inspection before shipment 出货前抽样检查

Appearance check



# Shipment 出货



**Finished products ready for shipment.**