Virtual Business Briefing & Factory Tour

June 3, 2021
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General Manager,
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Ajinomoto Co., Inc.
I. Overview of Functional Materials Business
  - Ajinomoto Group Vision and the Functional Materials Business
  - Overview of Ajinomoto Fine-Techno Co., Inc.

II. Electronic Materials Business
  - ABF Development
  - Market Conditions
  - Our Growth Strategy
I. Overview of the Functional Materials Business

Ajinomoto Group Vision and the Functional Materials Business

Ajinomoto Group Vision

Contribute to greater wellness for people worldwide, unlocking the power of amino acids to resolve the food and health issues associated with dietary habits and aging.
I. Overview of the Functional Materials Business

Ajinomoto Group Vision and the Functional Materials Business

Solve customer’s issues with applied technology based on fundamental technology that works across businesses

Function Design Technology
- Built a global network with bio and functional analysis
- R&D functions from Ajinomoto Fine-Techno Co., Inc. and others

Deliciousness Technology
- Development of packaged food products and food products for customers, foods with function claims, supplements, etc.

Leading-Edge Bioscience and Fine Chemical Technologies

Life Support
- Smart Material (Electronic Material)
- Animal Nutrition

Healthcare
- Bio Pharma Services
- Personal Care Ingredients
- Regenerative Medicine & Cell Therapy
- Culture Medium
- Aminoindex® & Solution
- Amino Acids for Pharmaceuticals

Foods
- Savory Seasonings
- Sweetener
- Food Enzymes
- Umami Ingredients
- MSG

Fundamental Research
- Analytical Science and Safety Evaluations
- Manufacturing Solutions

Technology Reinforcing Value
The Functional Materials Business Mission & Vision

Mission Statement
We will contribute to a “smart life” with high-performance fine chemical products.

Vision
To become recognized by our customers as the best partner by building a deeper relationship with them and helping to solve their problems and issues, and by providing the best service and highly-specialized high-performance fine chemical products.
I. Overview of Ajinomoto Fine-Techno Co., Inc.

Overview of Ajinomoto Fine-Techno Co., Inc.

Founded: September 1942
Capital: ¥315 million
Employees: 313
(as of April 1, 2021)

Electronic Materials Division
ABF

Functional Materials Division
Adhesives
Dispersing agents
Flame retardants

Activated Carbon Division
Activated carbon
Adsorption resin

6 million kWh of natural energy, equivalent to more than 50% of power used, is derived from biomass.

Application example
Disposable needles
Motor for HDD

Application example
Activated carbon for water purifiers, activated carbon filters
II. Electronic Materials Business: ABF Development

What is *Ajinomoto Build-up Film®* (ABF)?

*Ajinomoto Build-up Film®* (ABF)

Film-type insulation material protecting the core components in personal computers

Cross-section of packaging substrate

- IC chip protection
- Signal transmission between IC and motherboard

Insulating material = ABF
II. Electronic Materials Business: ABF Development

Origins of the Electronic Materials Business

Effective use of by-products, intermediates, and technologies

- Sugarcane, etc. (Fermentation)
  - Glutamic acid
  - Monosodium glutamate (Umami seasoning AJI-NO-MOTO®’s principle ingredient)

- Raw material (Synthesis 1960s)
  - Intermediates
    - Caustic soda
    - Chlorine
  - Epoxy resin curing agent
    - Chlorinated paraffin (Flame retardants)
    - Phosphate ester (Flame retardants)

- Salt (1 Chlorine)
  - Inosine, Guanosine
  - Nucleotide seasonings

- Phosphorus oxychloride (3)
  - High value-added materials

1999: Advent of Ajinomoto Build-up Film® (ABF), an interlayer insulating material for semiconductor packaging
II. Electronic Materials Business: ABF Development
Why was ABF Adopted? (Background to Advent of ABF)

Organic (plastic)
- Inexpensive
- Thin
- Small
- Light

Expectations for wide-use!

Inorganic (ceramic)
- Expensive
- Big
- Heavy

Internet use

1990s
II. Electronic Materials Business: ABF Development
1999: Advent of ABF, an Interlayer Insulating Material for Semiconductor Packaging

Innovation in the manufacturing process of packaging substrates!

**Conventional technology**

- **Ink + printing process**
  - Many processes
  - Poor smoothness
  - Air bubbles remain between wiring

**New technology**

- **Film + laminating process**
  - The industry's first film material meeting all the requirements
    - High insulation reliability
    - Micro wiring
    - Adhesive
    - Reliable connection
  - Reduces the number of processes
  - Smooth surface
  - No solvent odor

Vacuum lamination both top and bottom in one go
II. Electronic Materials Business: ABF Development

Features of Ajinomoto Build-up Film® (ABF)

Builds an entry barrier with solutions closely connected to customer needs

Customer Manufacturing Process

1. Embedding
   ABF applied to circuit board

2. Processing
   Laser drilled vias for interlayer connections

3. Copper adhesion
   Desmear treatment*
   Electroless copper plating

4. Insulation reliability
   Pattern formation with photosensitive material

5. Warpage
   Circuit formation with electro-plating
   Peeling of photosensitive material

* A treatment to remove resin residue which forms when holes are formed by laser.

Proposed solution

We can make proposals that include the process by reproducing the customer manufacturing process!
II. Electronic Materials Business: ABF Development
The *Ajinomoto Build-up Film®* (ABF) Value Chain

Close collaboration with all companies in the value chain, not just direct with customers

The *Ajinomoto Group*
(Raw material purchasing, varnish manufacturing, R&D, technical support, ABF sales)

- **Ajinomoto Co., Inc.**
- **Ajinomoto Fine-Techno Co., Inc.**
- **Chemical manufacturers**
- **Equipment manufacturers**
- **Substrate manufacturing process**
  - ✓ Substrate processing
  - ✓ Bonding
  - ✓ Laser
  - ✓ Copper plating
- **Substrate manufacturers**
- **CPU manufacturers**
- **Electronics manufacturers**
II. Electronic Materials Business: ABF Development

The Ajinomoto Build-up Film® (ABF) Manufacturing Process

Asset light by outsourcing coating and logistics

Stage 1: Varnish production
Ajinomoto Fine-Techno

Pour in materials
Varnish stirring
Varnish filtration (removal of aggregates and foreign substances)

Stage 2: Coating and cutting
Outsourced

Refrigerated transport
Apply varnish on PET film
Dry

Stage 3: Warehouse storage
Outsourced

Packing (frozen storage)

ABF complete

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II. Electronic Materials Business: ABF Development
Applications of Ajinomoto Build-up Film® (ABF)

Expanding applications of ABF from PCs to other uses

Games
Servers, communication networks
In-vehicle

% per application (by quantity)

<table>
<thead>
<tr>
<th>Application</th>
<th>FY2013</th>
<th>FY2021(F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>Server / Network</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Others</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Game</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

In-vehicle

CPU, etc.
Semiconductor packaging

ABF, etc.

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II. Electronic Materials Business: Market Conditions
Semiconductor Market Environment

Semiconductor-related markets have been further accelerated due to COVID-19

PC market
Growing demand for telework and e-learning drives more need for computers

Server, network market
Further use of servers and communications with advent of 5G

Global semiconductor market ($ billion)

- CAGR: 6.7% (2019→2021)
- CAGR: 8.8% (2021→2030)

2017-2021: World Semiconductor Trade Statistics (WSTS), Fall 2020
2030: IBS Semiconductor market Analysis, Jan 2021

Even greater rollout and use of 5G from 2022, too
⇒ Fuels greater demand for a wide range of products such as AI and autonomous driving
Semiconductor market expected to more than double in next 10 years
II. Electronic Materials Business: Our Growth Strategy
For ABF in FY2020–2022 Medium-Term Management Plan

Maintain and continue current business, expanding new business

- **New Markets**
  - Data center server and communication applications associated with arrival of 5G

- **Existing Markets**
  - Continued adoption in PC and game markets

- **Products**
  - **New**
    - Efforts for smartphone applications
    - Grow new materials in existing applications
    - Inductor applications
  
  - **Existing**
    - Functional Materials
    - Inductors are parts that convert electrical energy into magnetic energy

- **New Products**
  - Ajinomoto Build-up Film® (ABF)
  - AFTINNOVA® (magnetic material)
II. Electronic Materials Business: Our Growth Strategy
ABF Market Penetration and New Market Development

Implement quick development cycle
Build a deeper relationship with customers, helping to solve customer problems and issues

Future packaging trends
- Micro wiring
- Larger, more layered

Construction of new R&D building aimed at further business expansion set for completion June 2022

Proposed solution
More detailed technical support and introduction of new products to meet customer needs through a quick development cycle

- Latest equipment facilities to carry out evaluations
- Larger space for experiments (60% bigger than before)
- Collaboration with customers
II. Electronic Materials Business: Our Growth Strategy
Develop Electronic Materials that Continue to Contribute to Achieving Advanced IT Modalities

By leveraging the industry’s highest level technological capabilities and advanced digital technology on the base of Ajinomoto Co.'s ABF, which is a key material for semiconductor package substrates, and by continuing to provide key materials through a development co-creation ecosystem, we will contribute to the achievement of advanced IT modalities.

Ajinomoto Group’s Intangible Assets x Smart R&B

Advanced IT Modalities
- Neurocomputing
- Quantum computing
- Optical computing

Participation in advanced platform consortium

Future Society
- High-speed communication
- Smart City
- Autonomous driving
- Decarbonized society

Development and co-creation ecosystem which leads the IT industry
II. Electronic Materials Business: Our Growth Strategy
A Business Network Supporting Greater Research

Ajinomoto Co., Inc.
Ajinomoto Fine-Techno Co., Inc.

- R&D
- Technical support
- Technical discussions with customers

- Sales and purchasing
- Manufacturing
- Quality assurance

Ajinomoto Fine-Techno USA Corporation

All the cutting edge information from silicon valley

Cupertino California

Taiso Commerce Inc.
Ajinomoto Shanghai Specialty Chemicals Co., Ltd.

Information from Taiwan and China, powerhouses in semiconductor manufacturing

Taipei City
ASV (The Ajinomoto Group Creating Shared Value)

- 5G networks
- Cloud / Data centers
- AI
- In-vehicle
- Education
- Smart cities
- Medical care
- Space
- Industry

Helping people to “Live well” through improved connectivity, improved communication, improved convenience, improved quality of life.
➢ Forward-looking statements, such as business performance forecasts, made in these materials are based on management’s estimates, assumptions and projections at the time of publication. A number of factors could cause actual results to differ materially from expectations.

➢ This material includes summary figures that have not been audited so the numbers may change.