

Market Structure and Technology Trends of Black Ink for Ink Jet Printer

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Strong Business Structure with Five Core Business

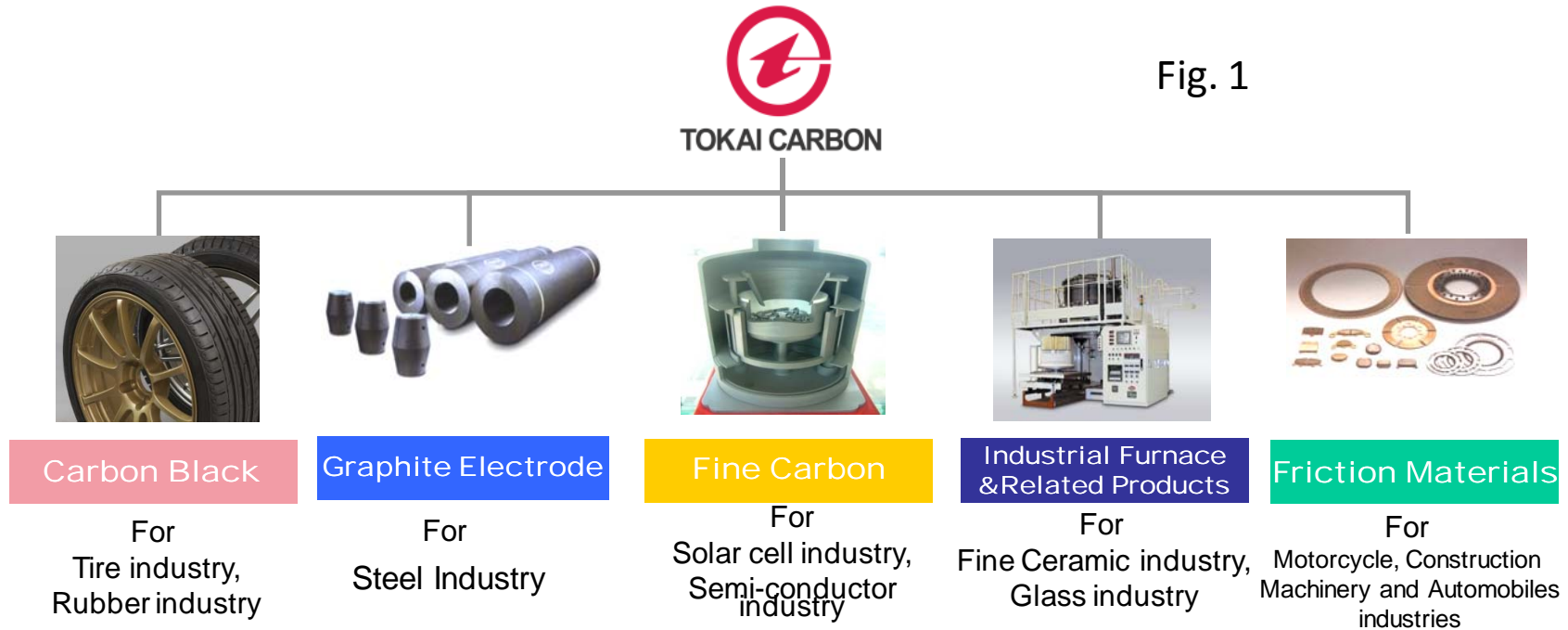
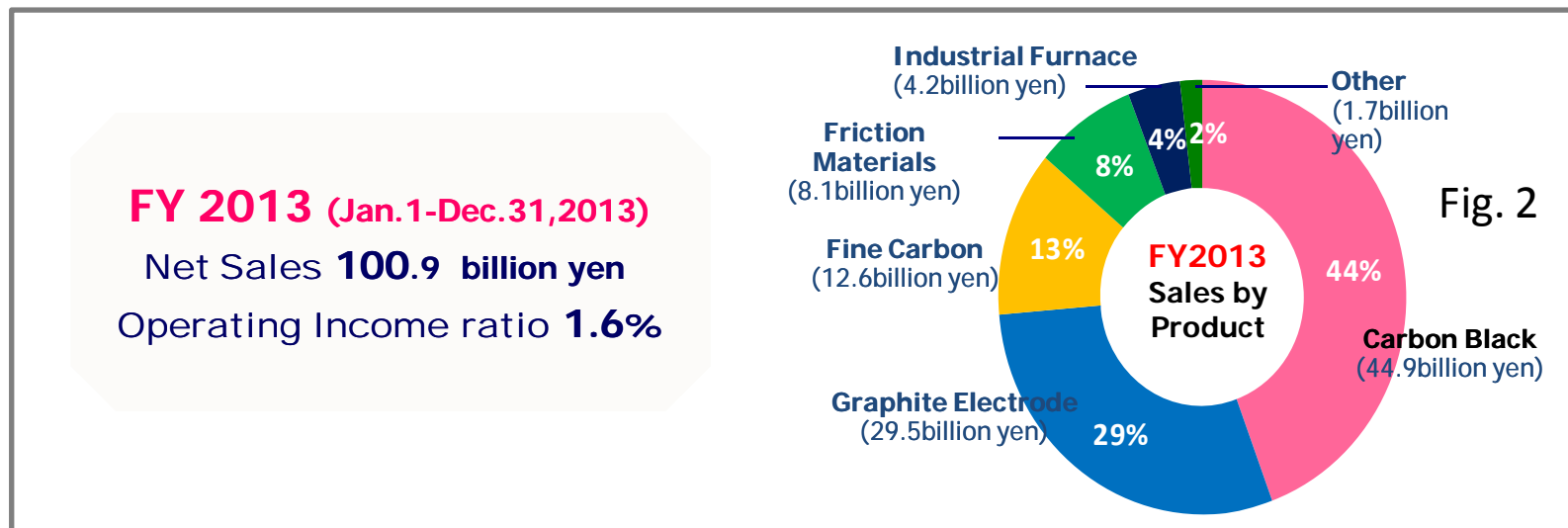


Fig. 1



Overseas Group Companies and Affiliates



Fig. 3

Aqueous CB Dispersion

To expand CB business,
Tokai Carbon started to develop
aqueous Carbon Black dispersion
for Ink Jet printer 20 years ago.

R&D : Fuji Research Laboratory

Production : Chita plant

The market structure of an ink-jet
is special. Its market structure and
technology trends of Black Ink will
be discussed in this presentation.

Fig. 4 Fuji Research Laboratory



Fig. 5 Chita Plant



Letterpress (Conventional) Printing

Developed by **Johannes Gutenberg** of Mainz in 1455

Expanded Printing Enterprise by **Aldo Manuzio** of Venice

Published Collected letters of Cicero in 1475

Published one work of ancient Greece
and the Roman Empire after another

**Letterpress printing became
the most important technology
from the medieval times of Europe
to modern times.**



Fig. 6

Logo mark of Aldine Press
From HP of
National Library of Scotland

Computer is changing The World

IBM released program stored computer, IBM701 for business use in 1952.

After then, a highly-efficientizing and a downsizing of computer have progressed abruptly.

Analog  Digital

Conventional game ⇒ TV Game

Analog Camera ⇒ Digital Camera

Photo by Silver Halide Tech. ⇒ Photo by Ink Jet Tech.

Letter / Facsimile ⇒ Internet

**Conventional Printing is also changing to
Ink Jet Printing now**

What is Ink Jet Technology

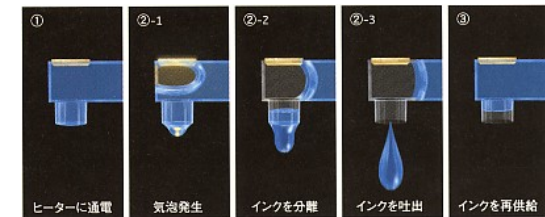
Ink Jet Printer doesn't work without Computer.

The mechanism of an IJ printer is simple.

1. Print Head
2. Sheet Feeder
3. Circuit Board
4. Power Supply
- and (5. Computer)**

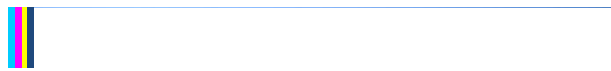
The most important part is Print Head
When required,
a required quantity of ink is jetted
from its nozzles

Fig. 7 Principle of Jetting



From HP of Canon

Serial Head and Line Head



Serial Head

Head moves by using wire
Higher Resolution
Lower Printing Speed
Easy to overcome Head Defects

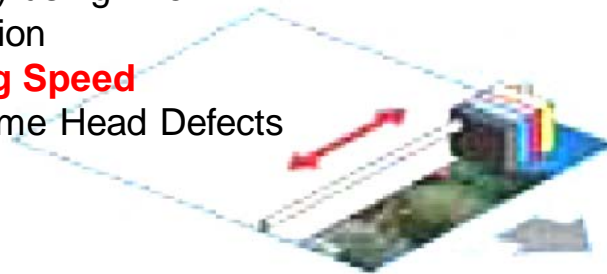


Fig. 8



Line Head

Head is fixed
Lower Resolution
Higher Printing Speed
Need a lot of Heads
Reliability of Head is needed



Fig. 9

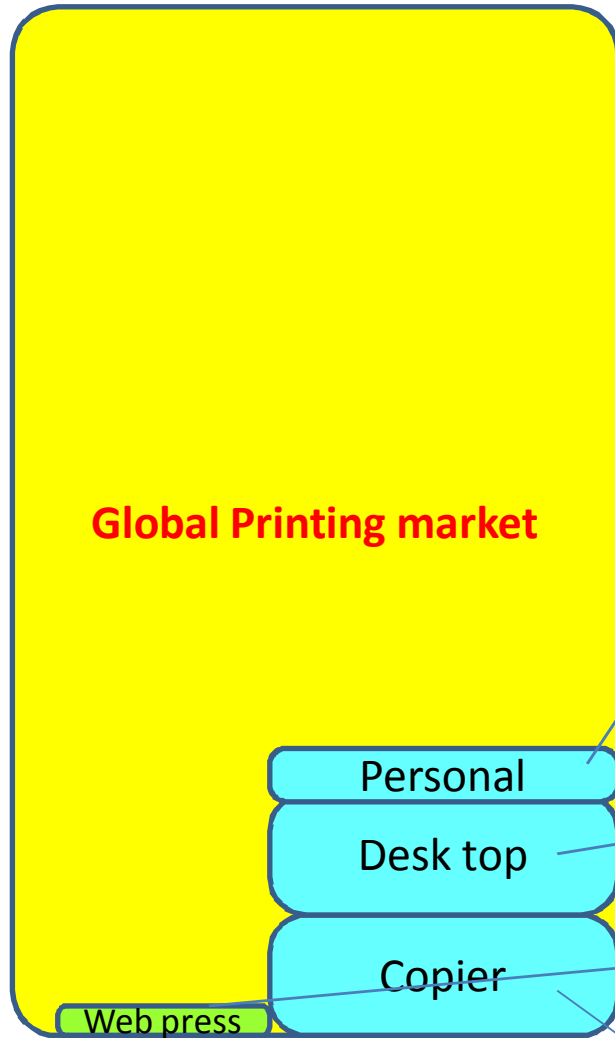
The feature of ink-jet technology

- ☺ **Digital Printing** Variable Data, On demand printing
Bill (Visa etc.), Form (Deutsche Bank etc.)
- ☺ **Non-impact Printing** Few restrictions of surface form
Irregular drawing board, Cloth, Sphere
- ☺ **Small Print Head** Easy to speed up, Easy to colorize
Web press
- ☺ **Super-thin nozzle** Easy to print highly minute
Photo
- ☺ **Functional Inks** Aqueous, Non-aqueous, UV Curable, etc.
Graphics, Drawing Electronic Circuit, 3D

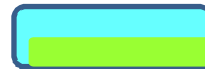


IJ Technology is expanding to many directions now.
Tokai Carbon is focusing only aqueous Carbon Black now.

Fig. 10 Global Printing Market



: Conventional Printing]
= Forme Printing
= Letterpress, Offset,
Gravure etc.



: Digital Printing]
= Formeless Printing
= Laser, Ink Jet

Global Printing Market 740 B\$



Personal Printer 20 B\$
Desktop Printer 50 B\$
Copier 50 B\$
Web Press 2 B\$



Fig. 11



Personal, Desktop & Copier



Personal
Ink Jet



Desktop
Laser



Copier
Laser



Ink Jet Printer will replace Laser Printer gradually

Mechanism of Ink Jet Printer is more simple compare to that of Laser Printer.

Table 3

| | 25 years ago | Current | 10 years later |
|----------|--------------|---------|----------------|
| Personal | Laser | Ink Jet | Ink Jet |
| Desktop | Laser | Laser | Ink Jet |
| Copier | Laser | Laser | Laser/Ink Jet |

Example of Market Participants of Conventional Printing & Ink Jet Printing

Table 3

| | Conventional | Ink Jet |
|----------|---------------------|---------------------------------|
| Printing | Giesecke & Dervient | unitedprint |
| Machine | Heidelberg | HP, Canon, Epson Brother etc |
| Ink | Sun Chemical | |
| Paper | International Paper | |

**In the case of Ink Jet,
Printer Manufacturer supplies
not only Machine (Printer) but also Ink and Paper.**

Of course, Printer manufacturer is buying
Pigment Dispersion from Dispersion Manufacturers
and Paper from Paper Manufacturers

They know consumables
business is profitable.

Web Press & Sheet-fed Press

**Heidelberg
Speedmaster XL 75**



Conventional Printer

Mass Printing

The biggest problem of the publishing trade is that it is necessary to discard the book when it does not sell.

**Hewlett Packard
T-300 Inkjet Web Press**



**Ricoh-IBM
InfoPrint 5000-VP**



Digital Printer

Small Quantity Printing

In the case of Digital Printing, one book can be easily prepared.

Quality of Black ink is the most important

Volume of Black ink occupies 60 % of Total ink volumes.

So, quality of Black ink is very important.

Especially, blackness is the most important.

The degree of blackness is expressed
as the measure of optical density(OD).

| | Offset | NEWS paper | Electrophotography | Ink Jet |
|----------|---------------------|------------|--------------------|-------------------|
| OD Value | > 1.7* ¹ | 1.2 | 1.5* ² | 1.4* ² |

*1 : Coated paper, *2 : Plain paper

OD value of printed image is requested over 1.5 for plain paper
for Ink jet printing
to replace
Electrophotography printing in the market.

New Aqueous Carbon Black

Latest Carbon Black Dispersion developed at Fuji Research Lab. of Tokai Carbon shows good performance of OD value over 1.5

New Aqueous Carbon Black of Tokai is getting an excellent evaluation results from customers.