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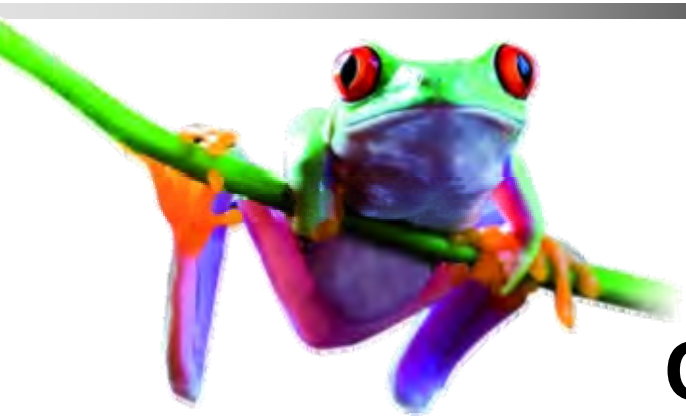

Colour Toner - Conventional or Chemical

The Practical Issues

Topics

- **Conventional Toner**
  - **Spheridising**
- **Chemical Toner Manufacture**
  - **Alternative Processes**
- **Performance Comparisons**
  - **Image Quality**
  - **Cost**
  - **Reliability**
- **The Future**
  - **Why are the OEMs turning to Chemical Toner?**

Anatomy of a Toner Particle (Conventional)

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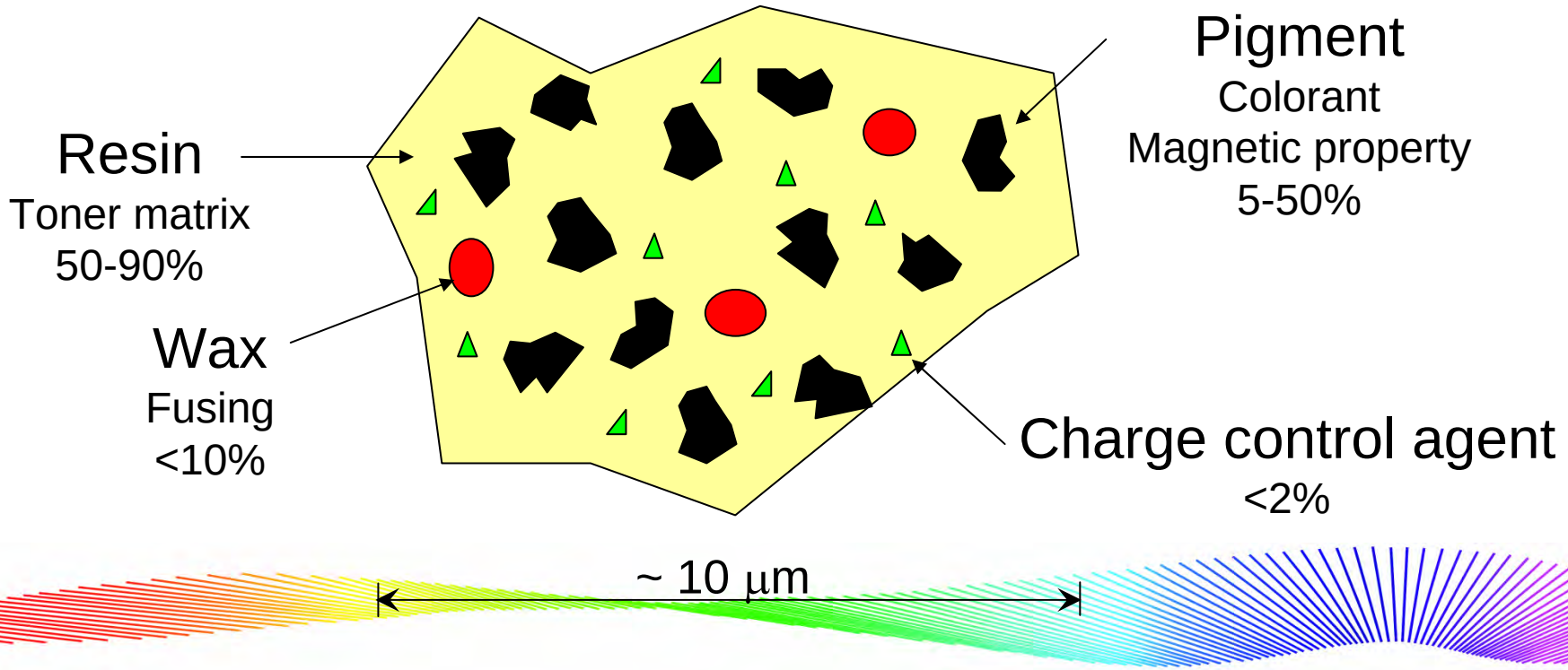
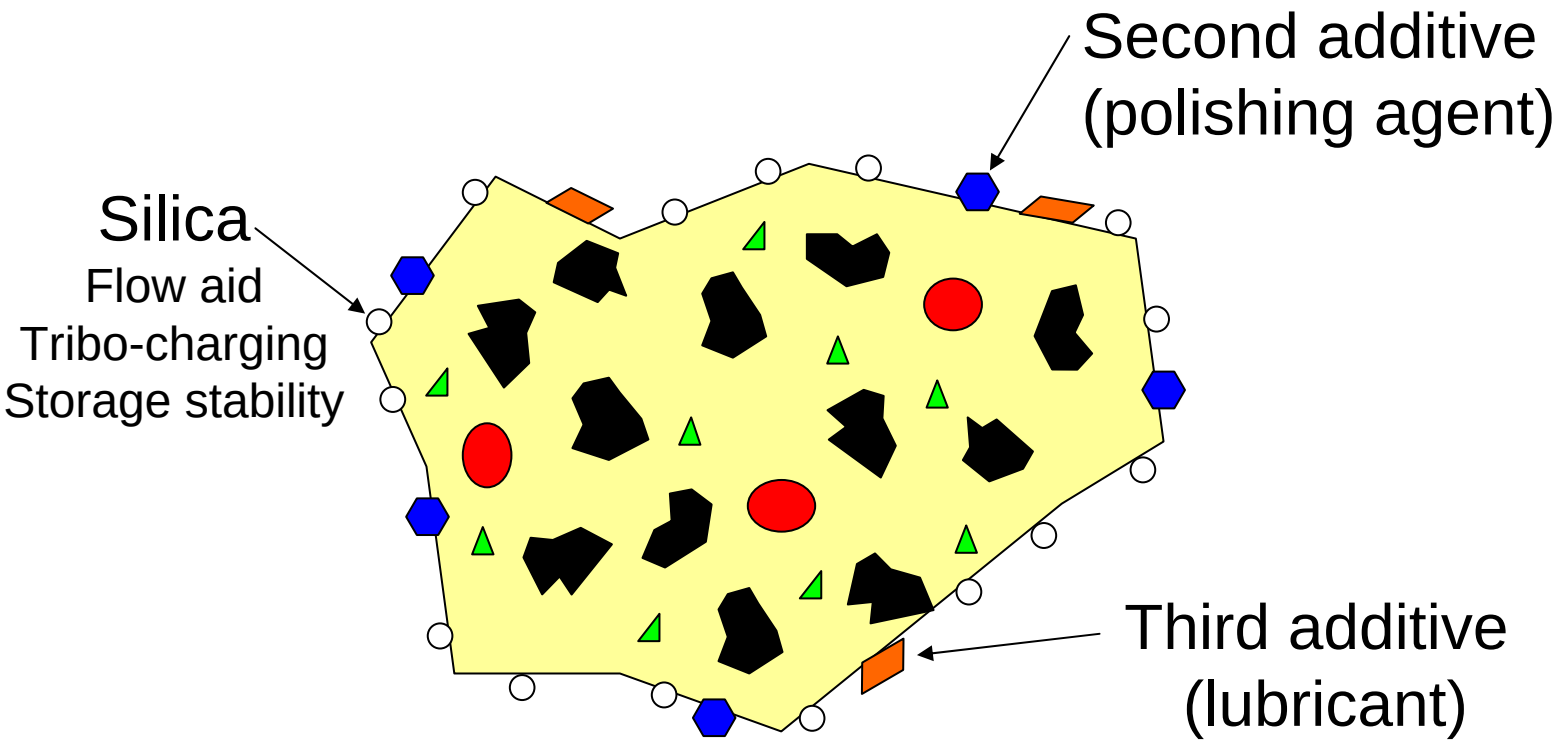
- **Internal Structure**



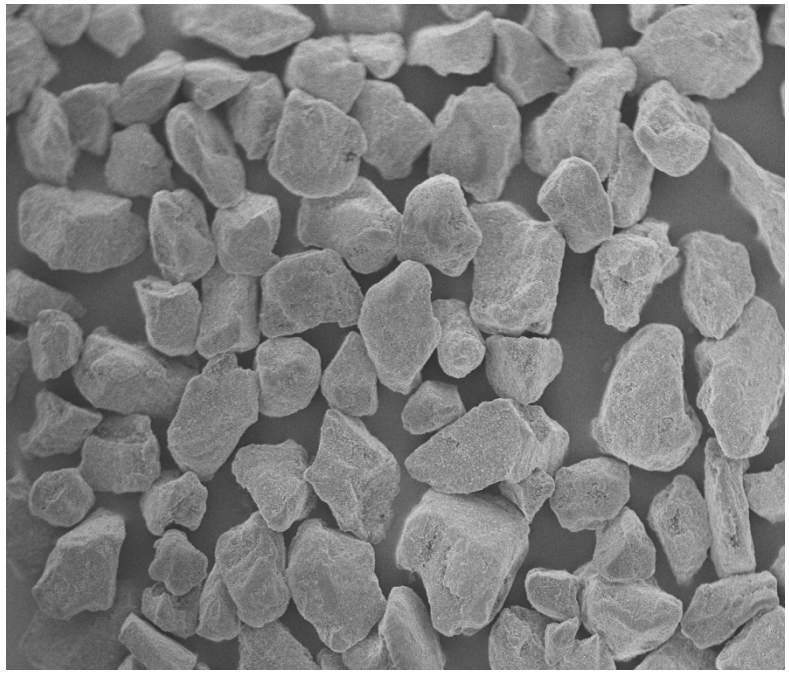
Anatomy of a Toner Particle (Conventional)

- **External Additives**



Conventional Toner

- **Pulverization**
  - **Strong Points:**
    - Inexpensive
    - Well understood technology
  - **Weak Points:**
    - Large particle size distribution
    - Higher pile heights
    - Poor interaction with OEM
    - Poor fusing
    - Wax is not encapsulated
    - Non-uniform shapes
    - Poor toner flow

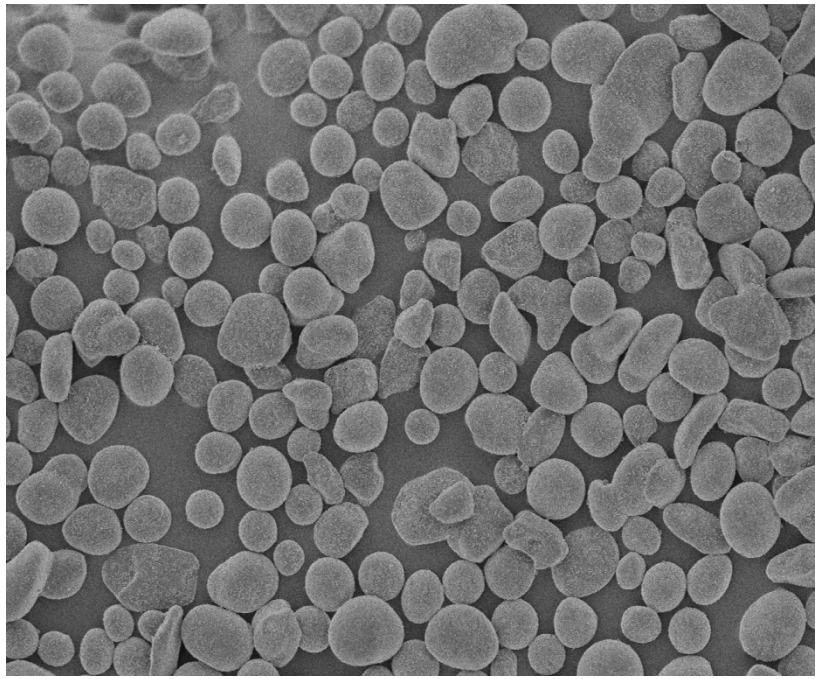


Conventional Toner

- **Spheridising**

  - **Conventional toner is produced and then smoothed by heat and mechanical process.**

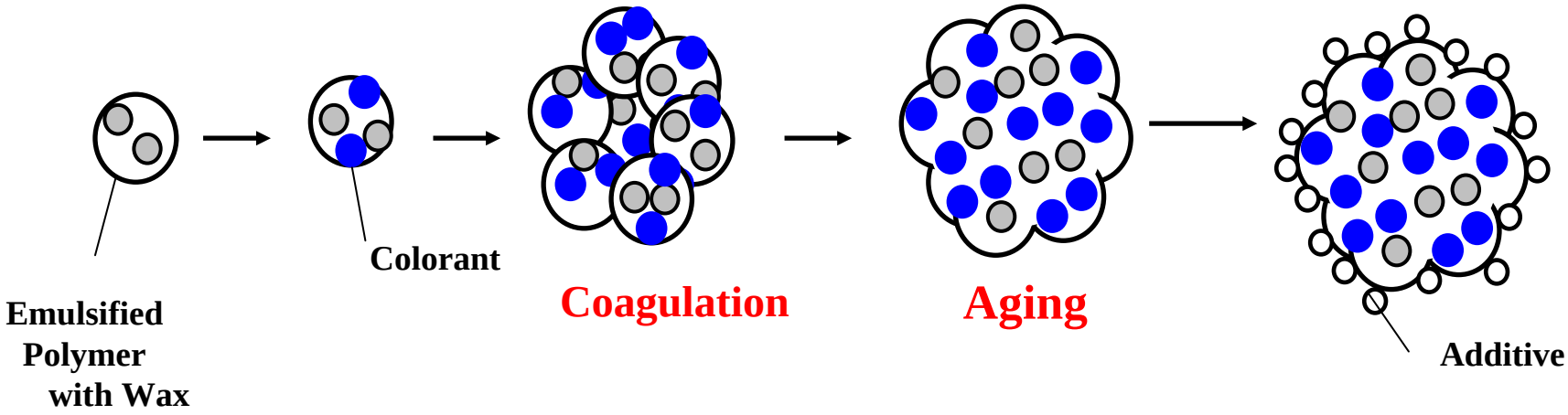
  - **Strong Points**
    - **Less expensive than chemical**
  - **Weak Points**
    - **Wide particle size distribution**
    - **Higher pile heights**
    - **Interaction with OEM**
    - **Poorer fusing**
    - **Non-uniform shape**
    - **Wax on surface – poor flow**



Chemical Manufacturing Methods (1)

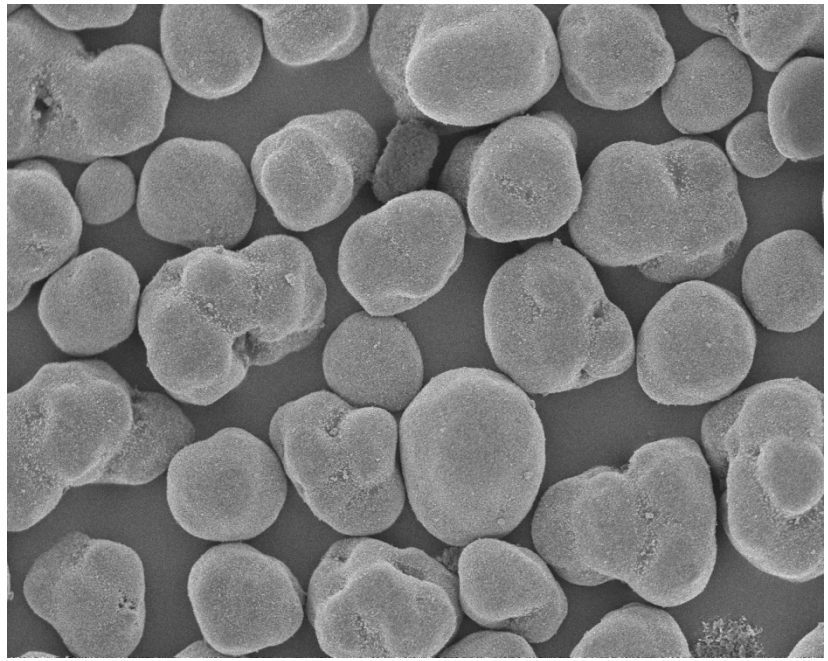
- **Emulsion Aggregation**
  - **Coagulation**

Anatomy of a Toner Particle (Chemically Produced)



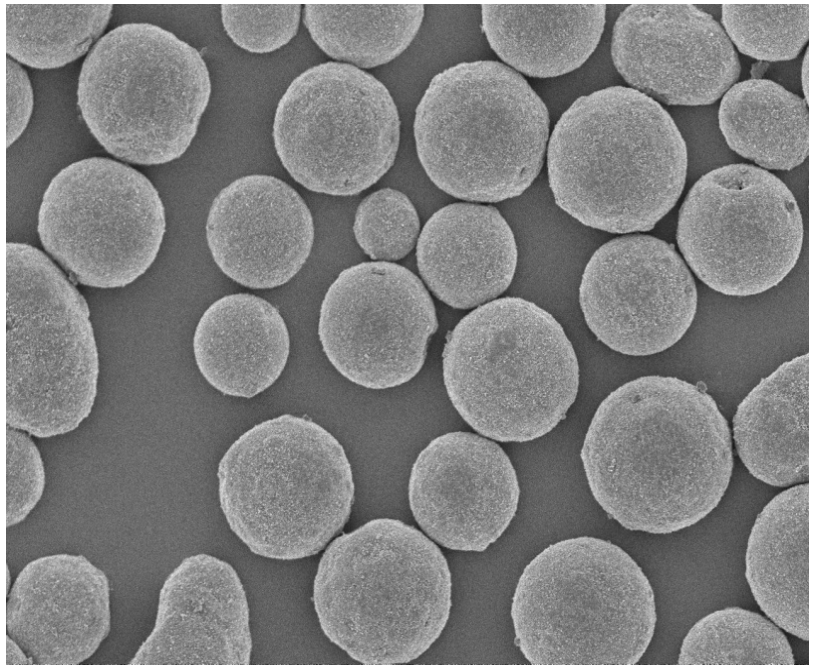
Chemical Manufacturing Methods (1)

- **Emulsion Aggregation**
  - Coagulation
  - Strong Points:
    - It's a smooth potato shaped
    - Cleans easier
    - Tight particle size distribution
    - Good fusing
    - Wider colour gamut
    - Better control of particle shape
    - Glossy or matte finish
  - Weak Points:
    - Complex process
    - Difficult to use polyesters



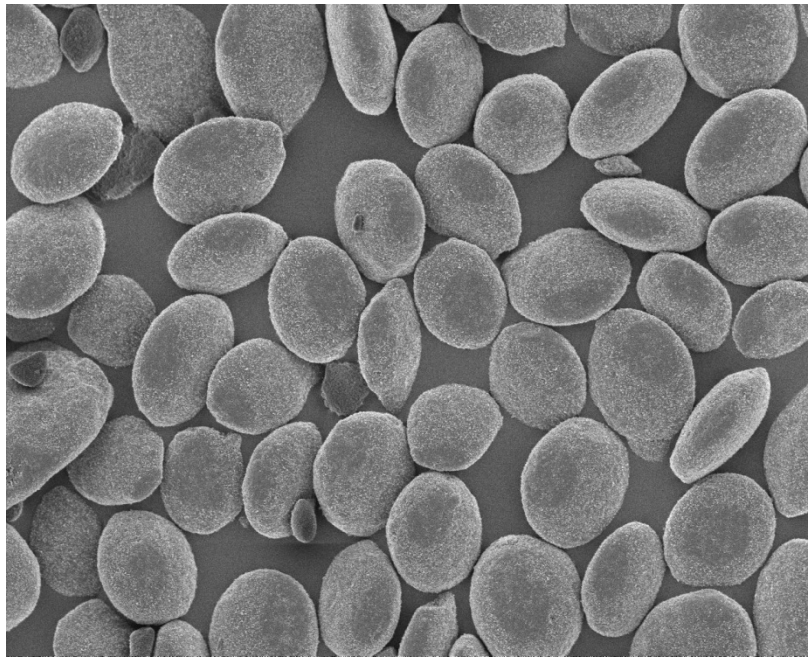
Chemical Manufacturing Methods (2)

- **Suspension Polymerisation**
  - **High-speed Dispersion**
  - **Strong Points:**
    - **Round**
    - **Good Charge Control, Flow and Transfer**
    - **Perfect match with the OEM**
  - **Weak Points:**
    - **Difficult Cleaning**
    - **Heavily Patented**
    - **Limited to Spherical Shapes**



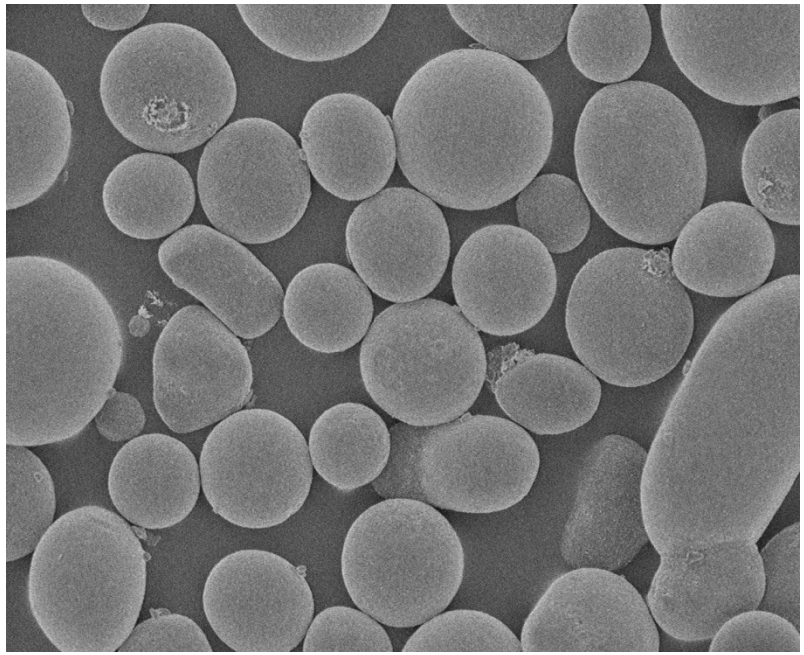
Chemical Manufacturing Methods (3)

- **Polyester (Elongation) Polymerisation**
  - **Components are mixed with a solvent and processed through high shear mixing.**
  - **Strong Points:**
    - **Narrow Size Distribution**
    - **Wide Fusing Range**
  - **Weak Points:**
    - **Difficult to polymerise particles directly to size**



Chemical Manufacturing Methods (4)

- **Chemical Milling**
  - Components are mixed with a plasticiser, melted, and processed through high shear mixing.
  - Strong Points:
    - Enables easy use of all conventional resins, including polyesters
    - Simple process – low investment
    - Good colour gamut
    - Surface roughness can be controlled
    - Can use either dye or pigments for colorant
  - Weak Points:
    - Solvent based process
    - Potential for solvent fumes during fusing
    - Poor image permanence with dye colorants



Performance Comparisons (1)

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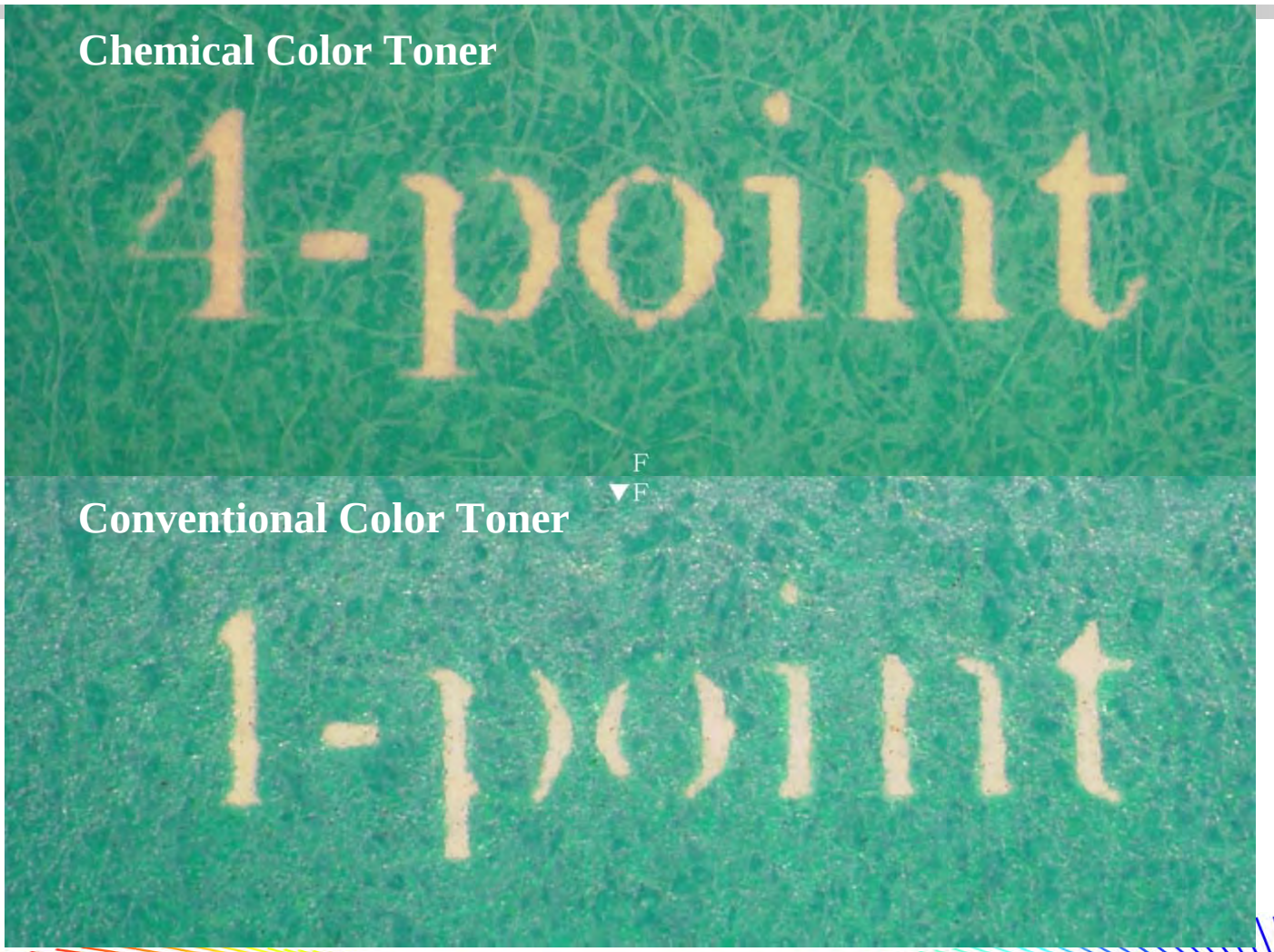

Performance Comparisons (2)

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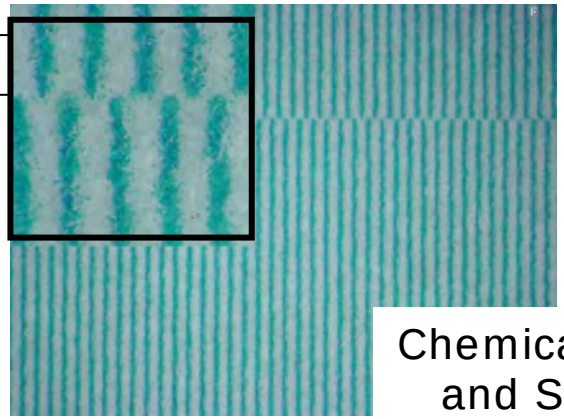
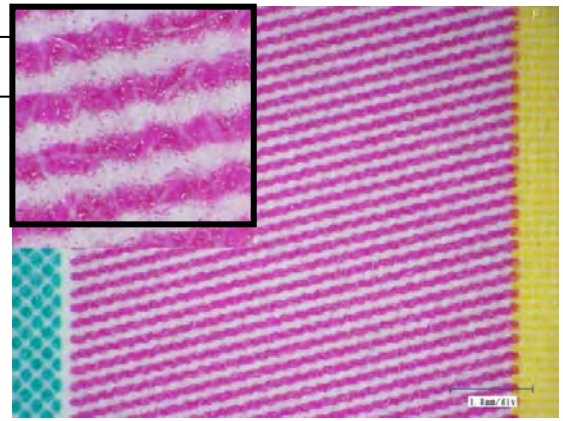
Chemical Toner

Zoom up

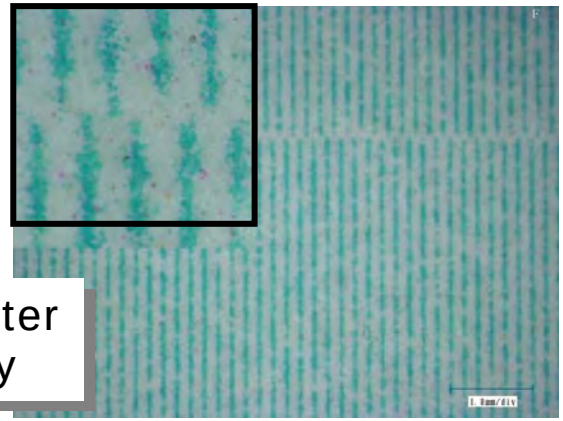


Zoom up

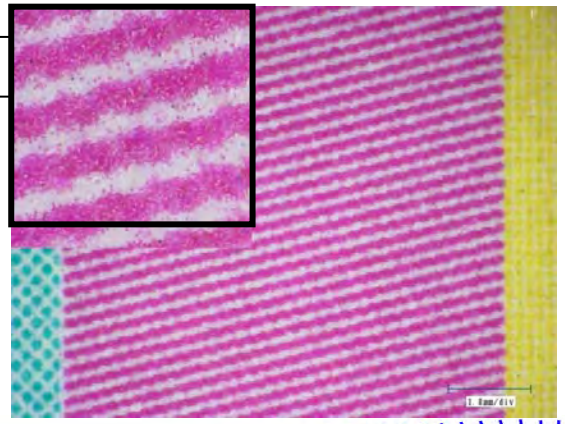


Conventional Toner

Zoom up



Zoom up



Chemical Toner shows Better and Smooth Print Quality

Performance Comparisons (3)

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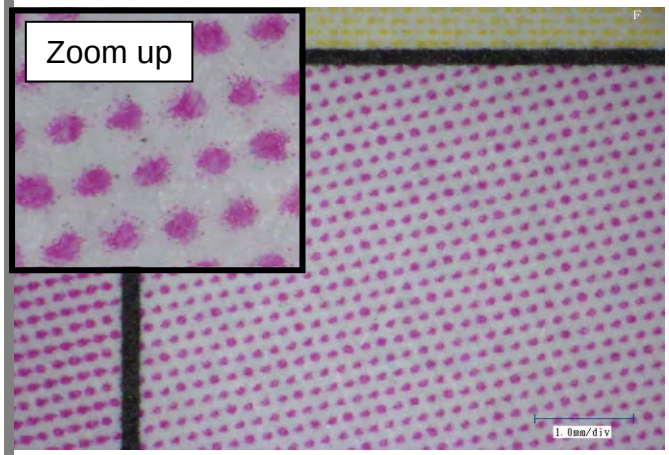
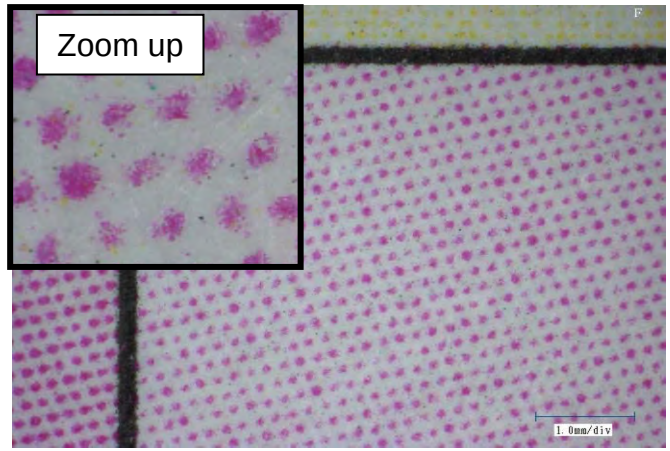
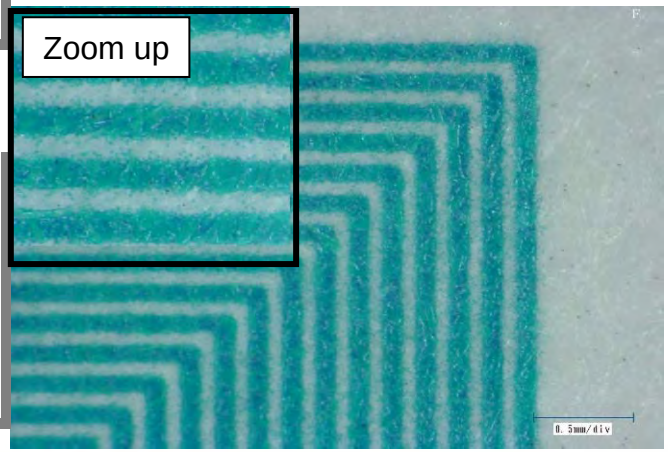
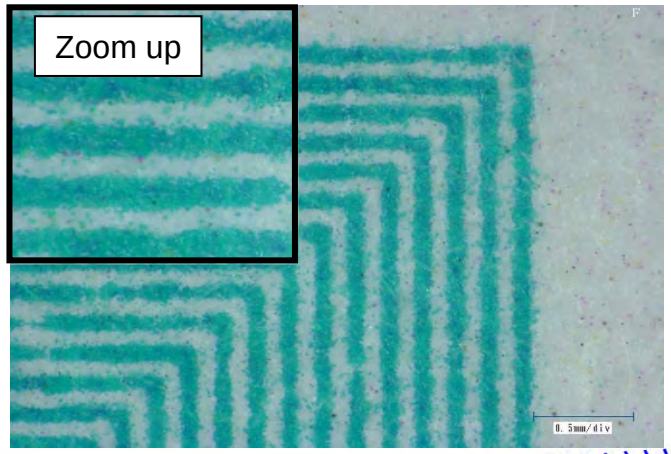
	Chemical Toner	Conventional Toner
Chemical Toner shows better dot shape = Smooth Half Tone		
Chemical Toner shows smooth thin lines		

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Performance Comparisons (4)

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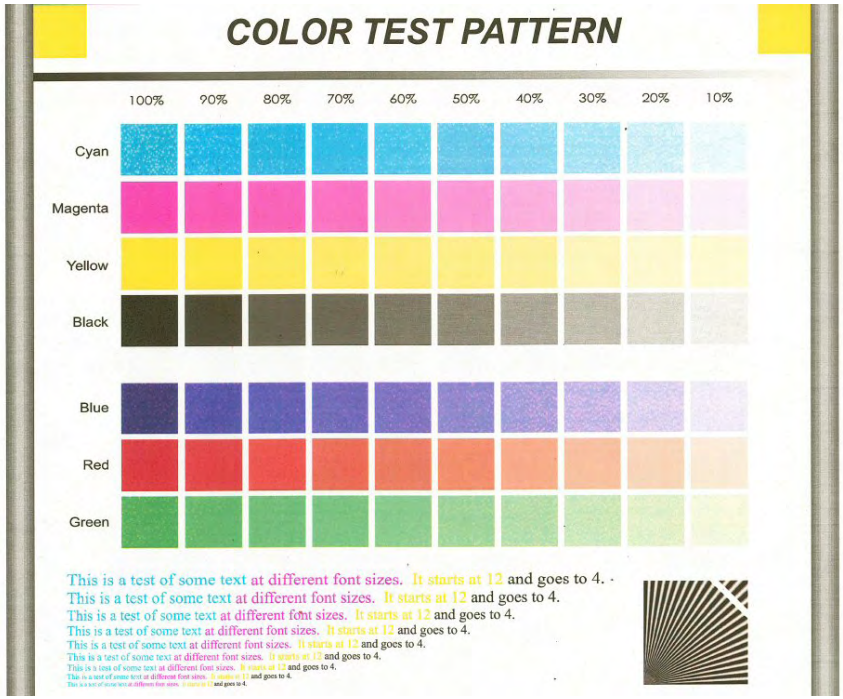
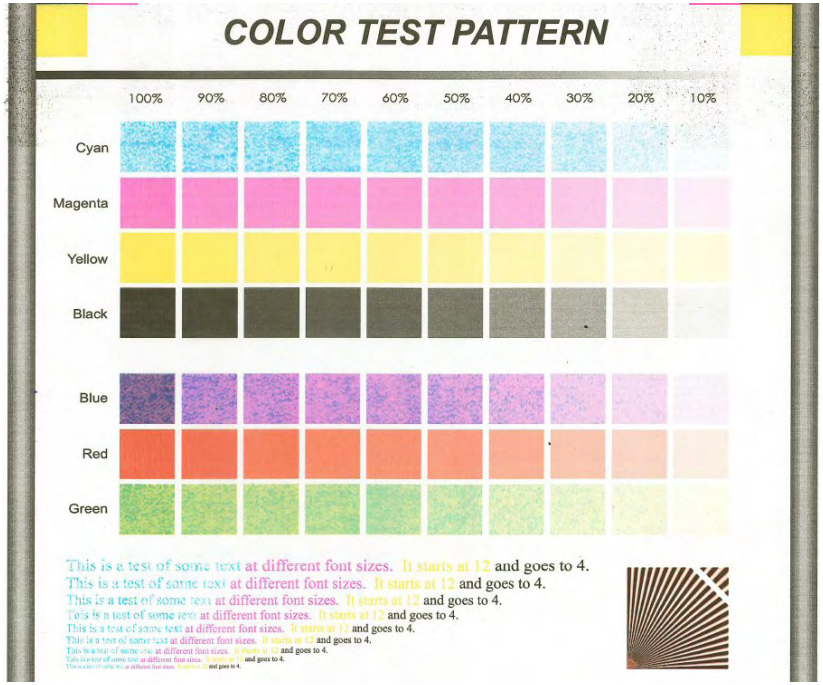
- **Transparencies**



Chemical Toner



Conventional Toner

Performance Comparisons (5)

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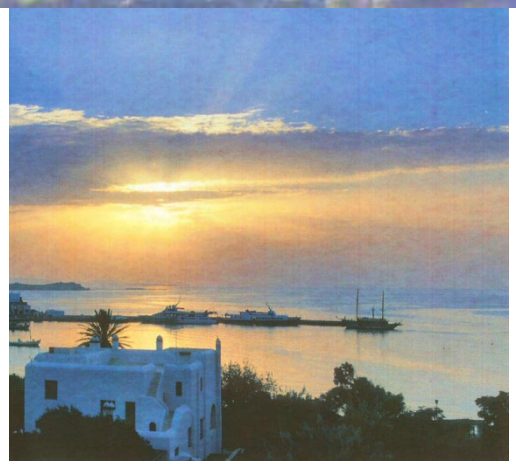
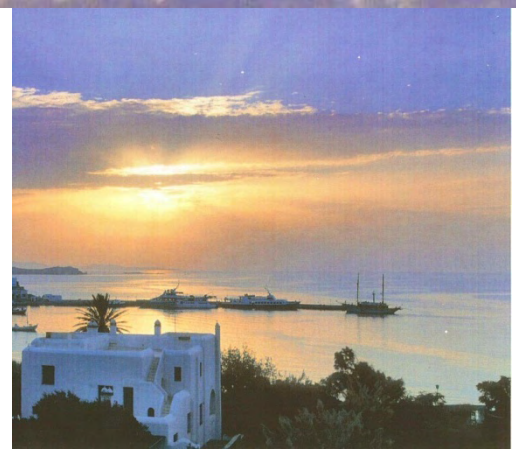
- **Photo Paper**



Chemical Toner



Conventional Toner

Performance Comparisons (6)

Pile Height

Chemical Toner – 2 microns

Conventional Toner – 7 microns

Lower pile height = Less energy to print

Higher speeds

Longer hardware life

Higher image quality

No “toner feel”

No paper curl

Performance Comparisons (7)

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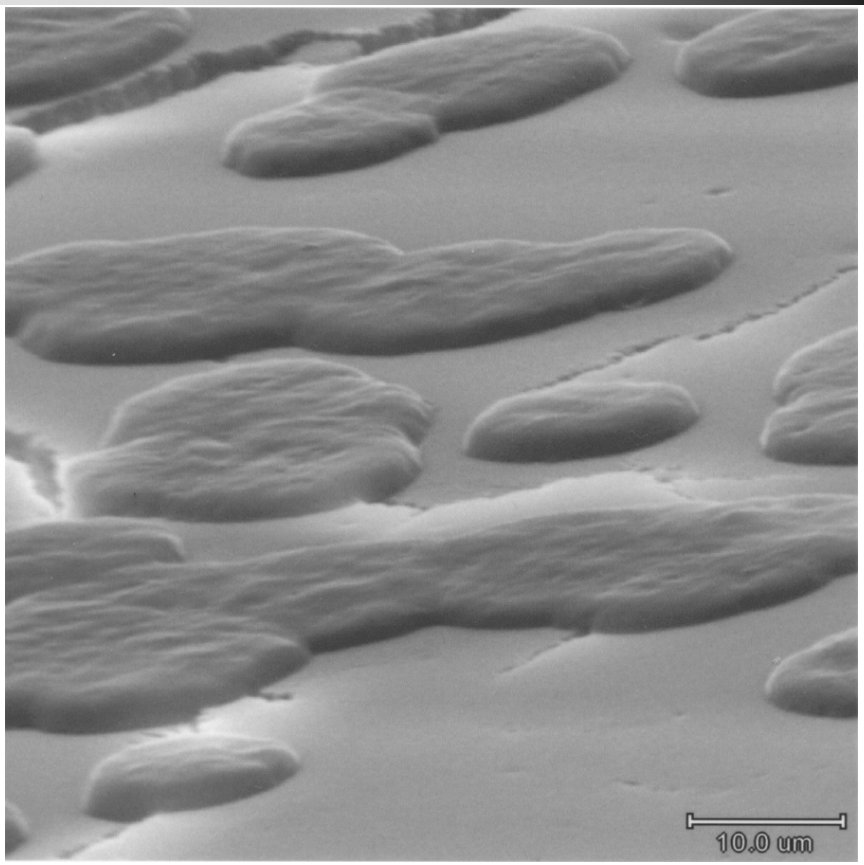
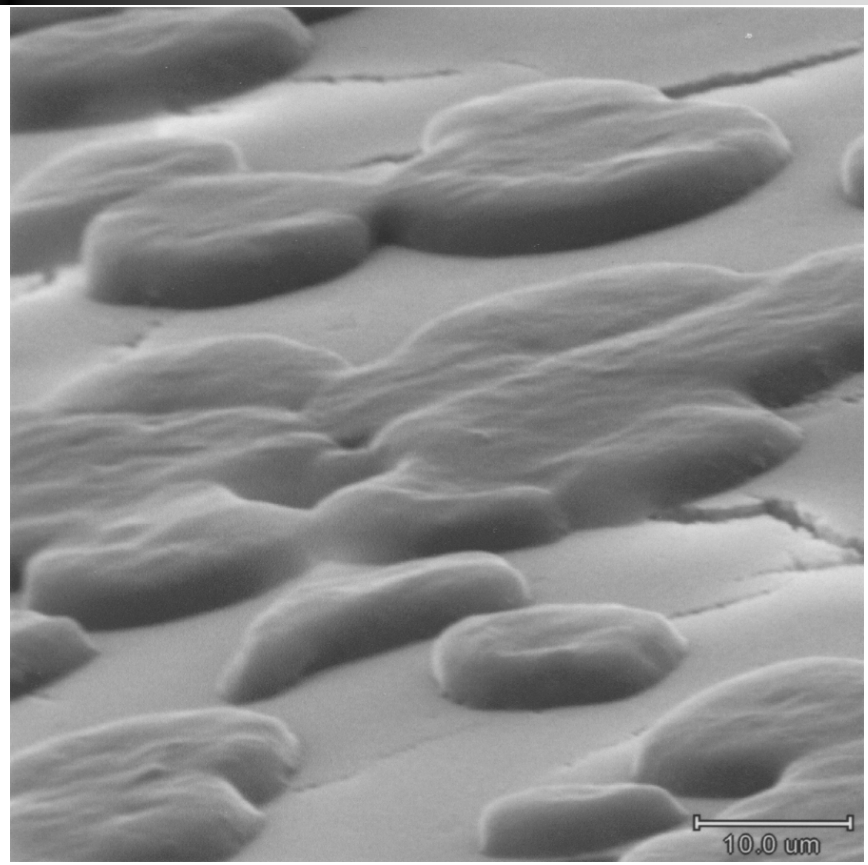


Chemical toner



Pulverized toner

HP4600 Black Print Example

Performance Comparisons (8)

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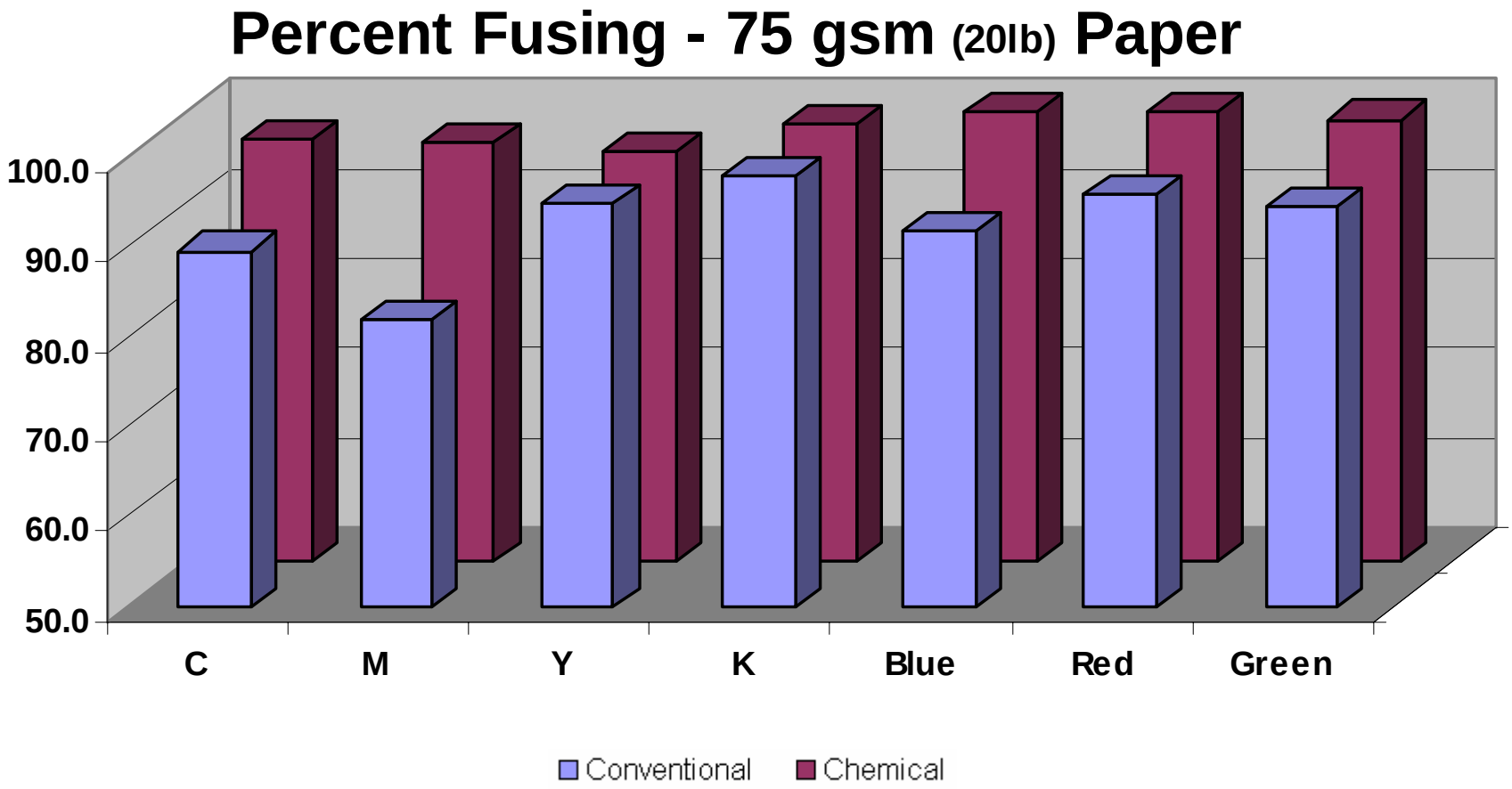

Performance Comparisons (9)

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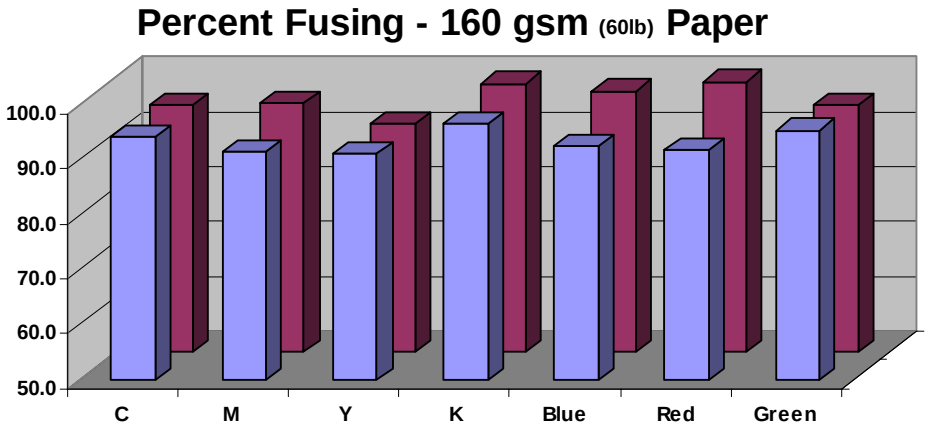

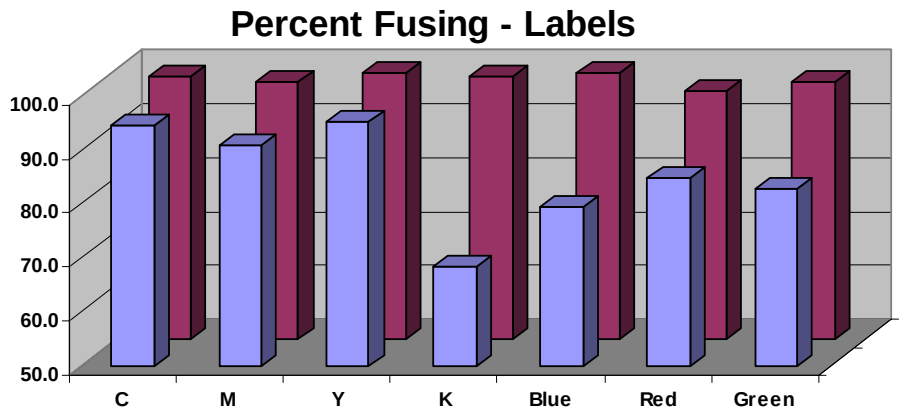

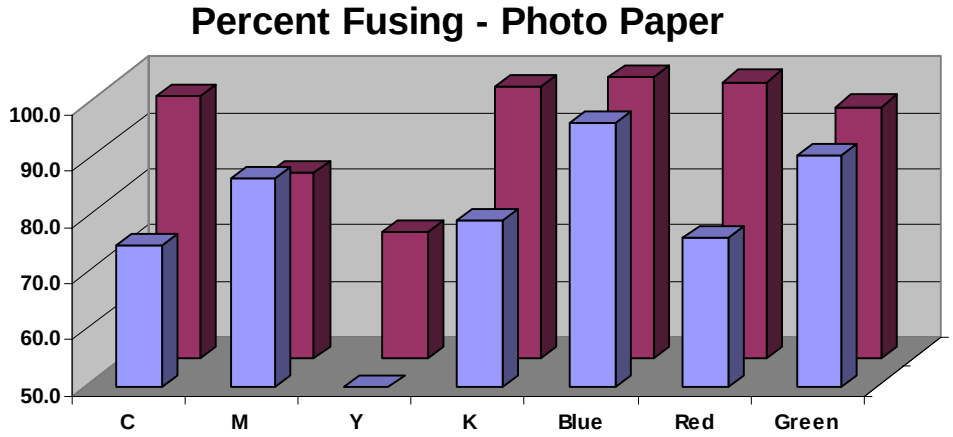

Conventional Chemical

Performance Comparisons (10)
Cost Savings?

Performance Comparisons (11)

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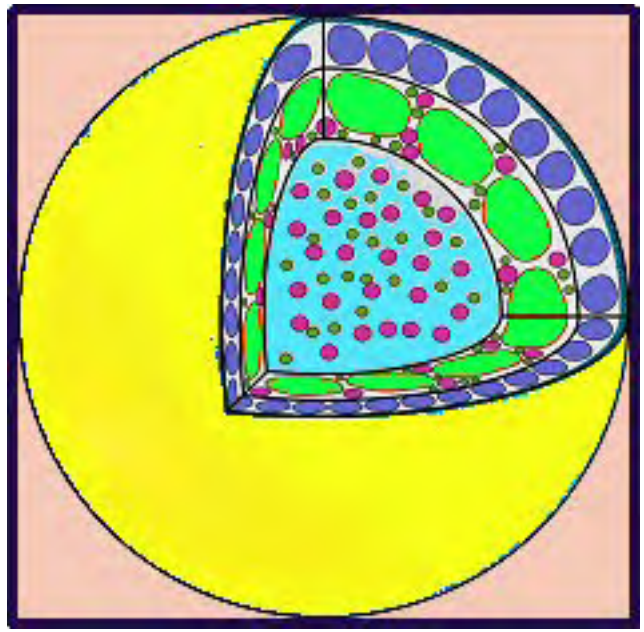
Encapsulation

- Wax and colorant on the inside- shell on the outside
- Benefits of encapsulation
  - Shell
    - Mechanical strength
    - Thermal stability
    - Good charging properties
    - Thickness can be varied giving different properties
  - Core
    - Wax on the inside gives better flow characteristics
    - Charge is independent of the colorant



Performance Comparisons (12)
Encapsulation

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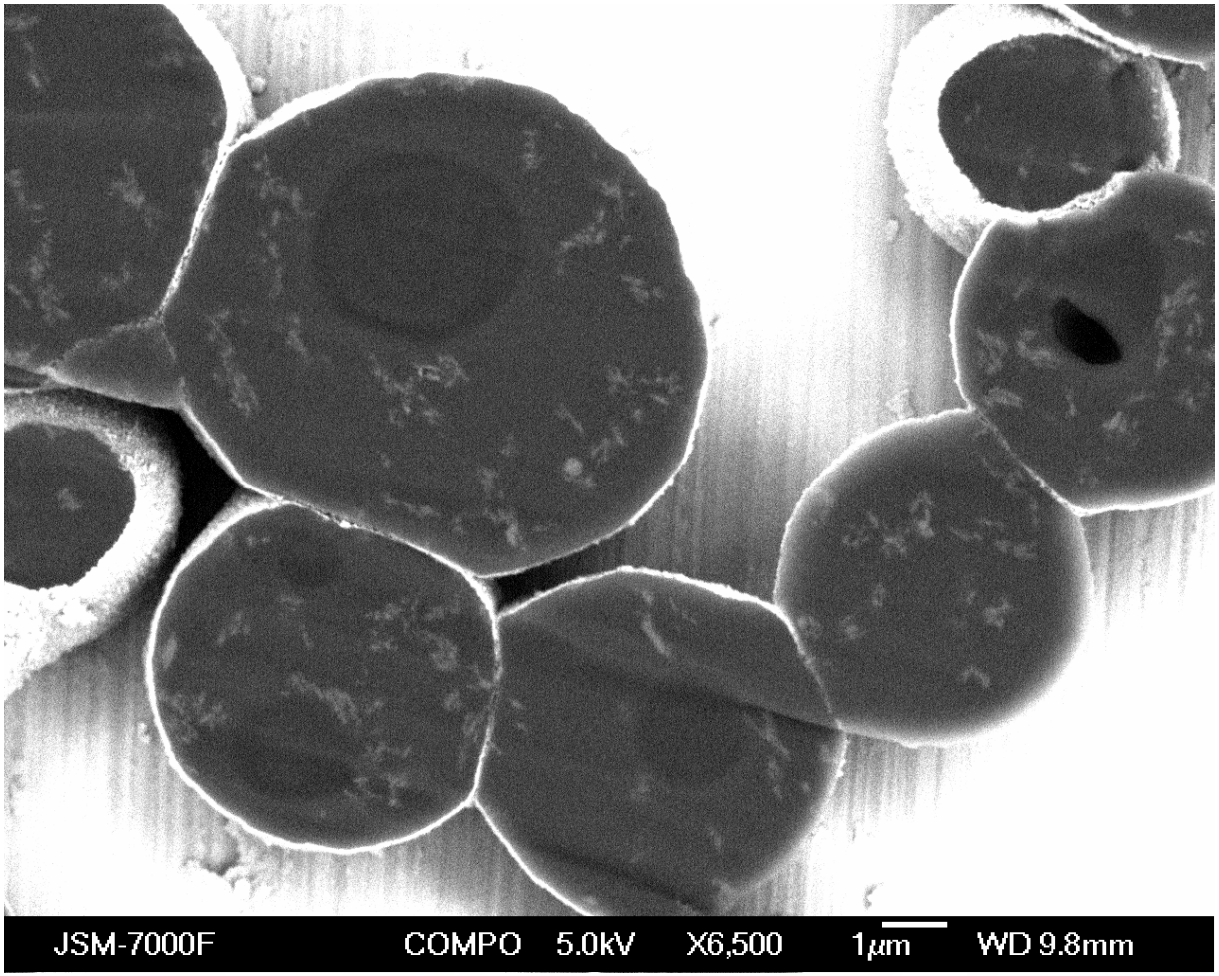

Performance Comparisons (13)
Toner ID

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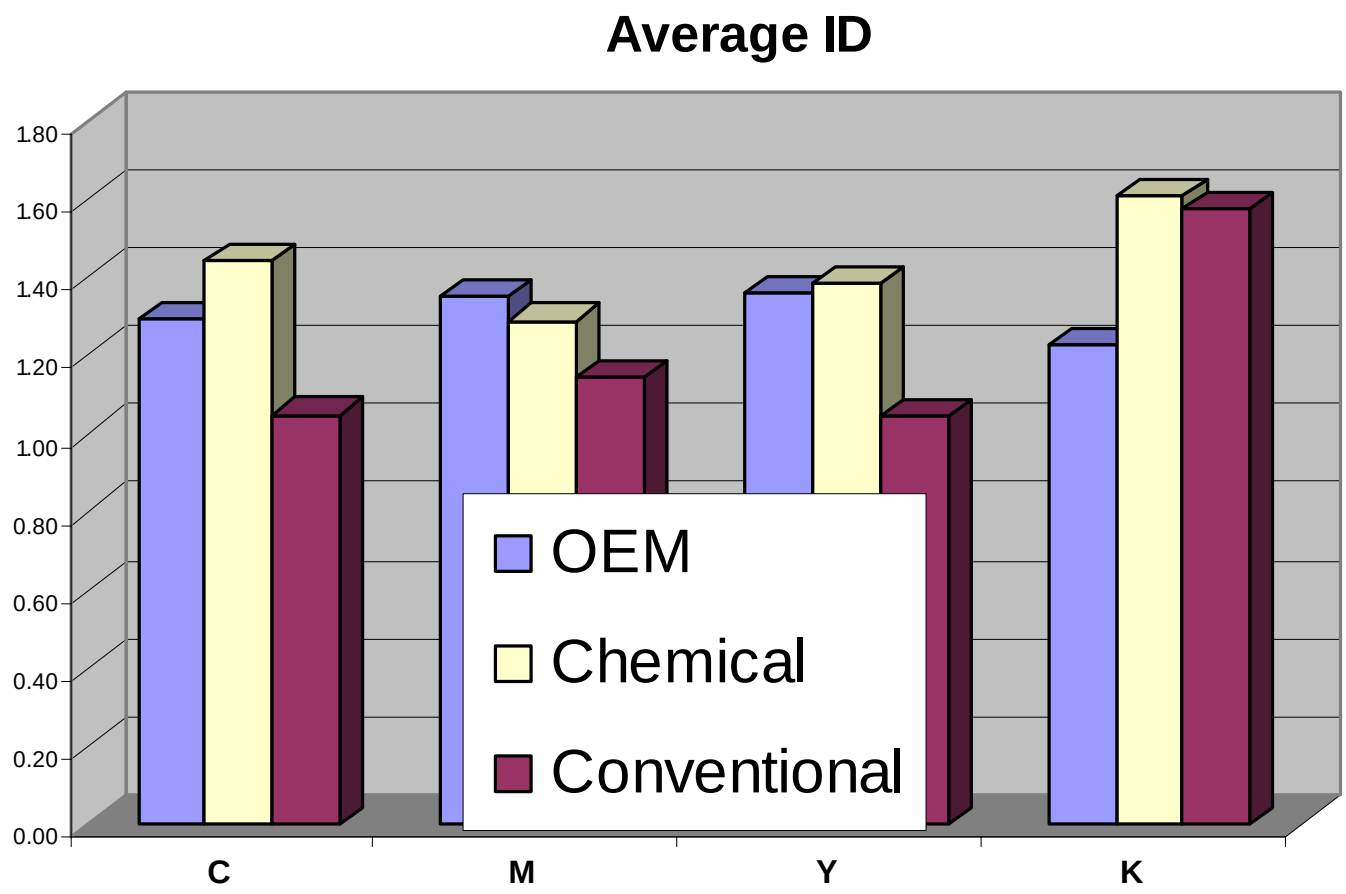
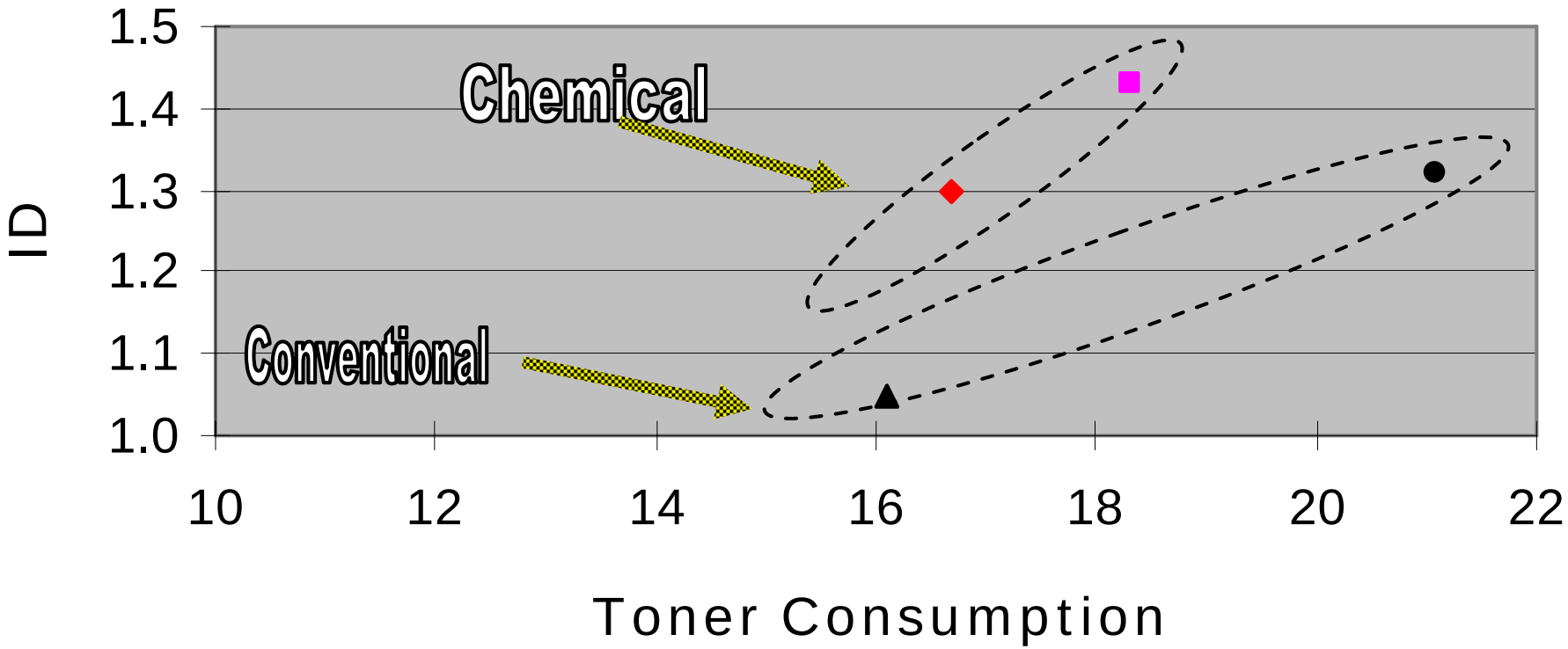
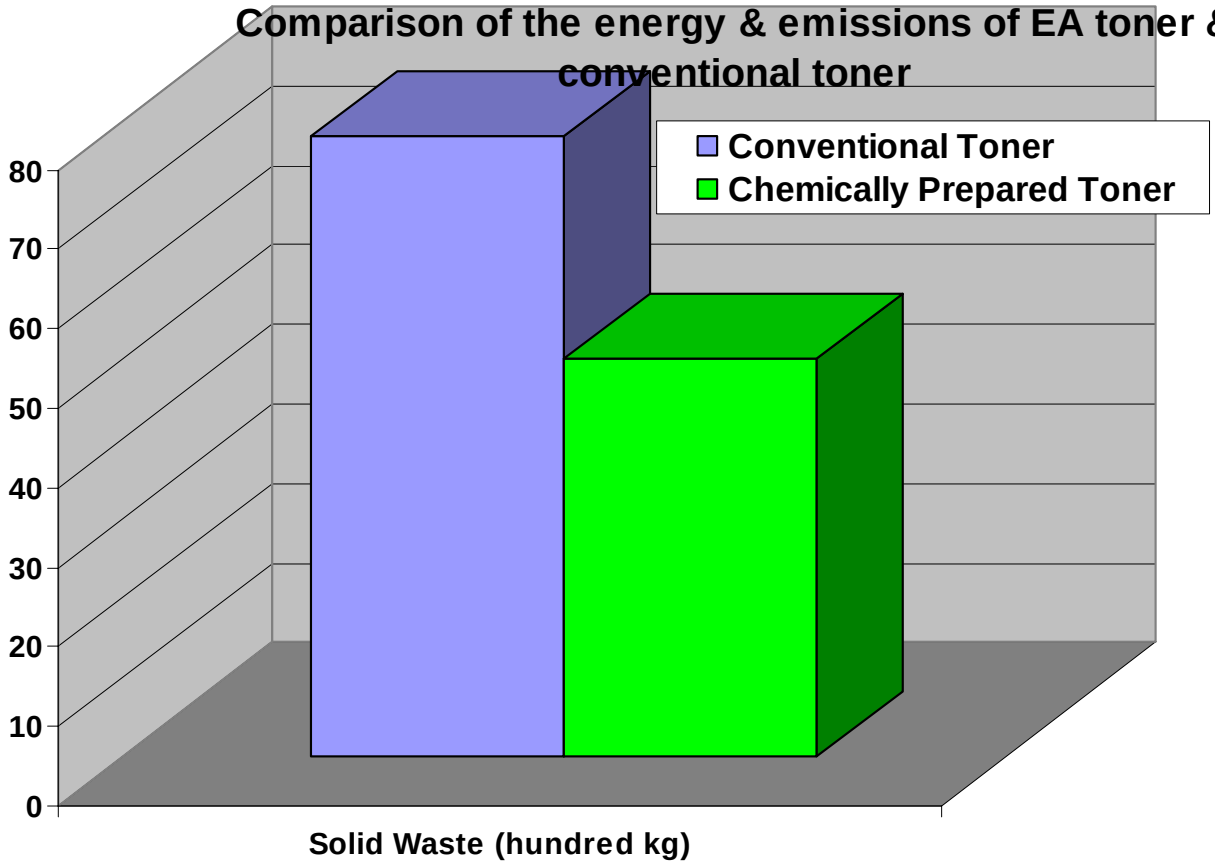


Performance Comparisons (14)
Toner ID



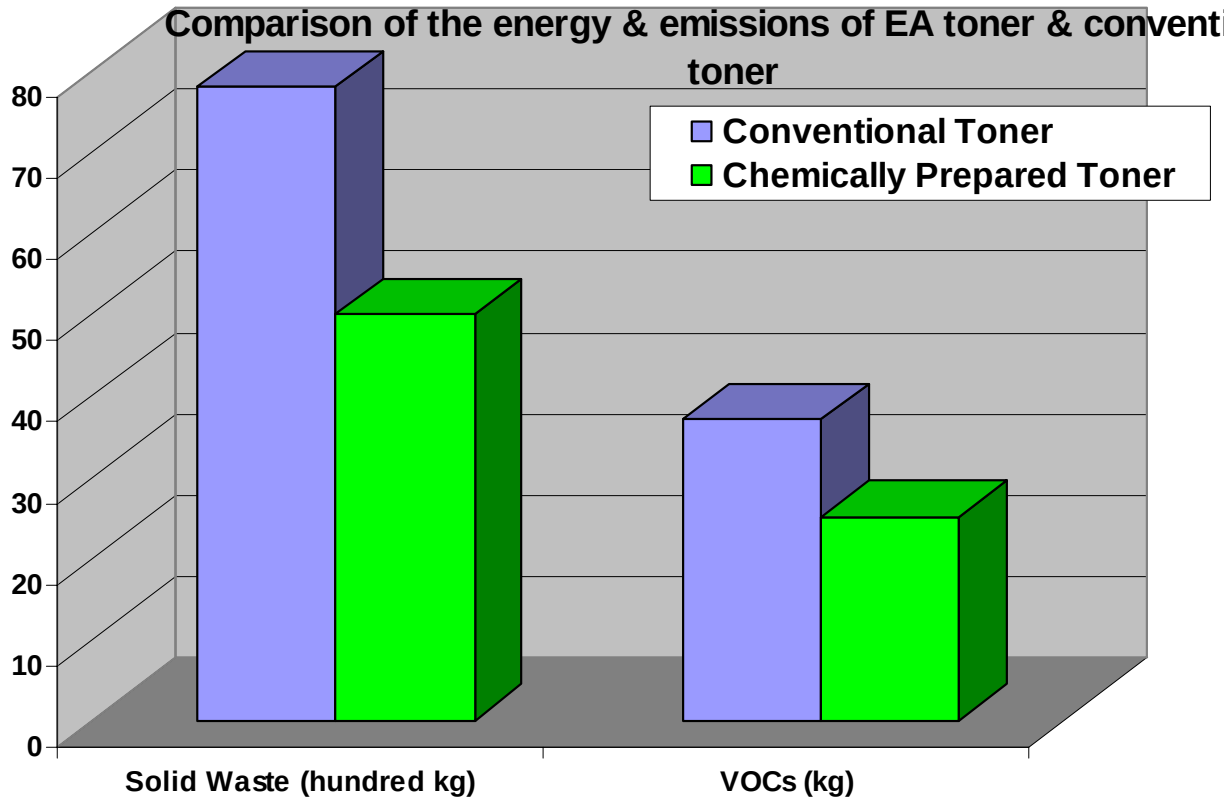
CHEMICAL TONER IS MORE GREEN!



Per metric ton of toner produced and used.

Source: Ahamadi, A, et al, Life-cycle inventory of toner produced for xerographic processes, J Cleaner Production, 2001

CHEMICAL TONER IS MORE GREEN!



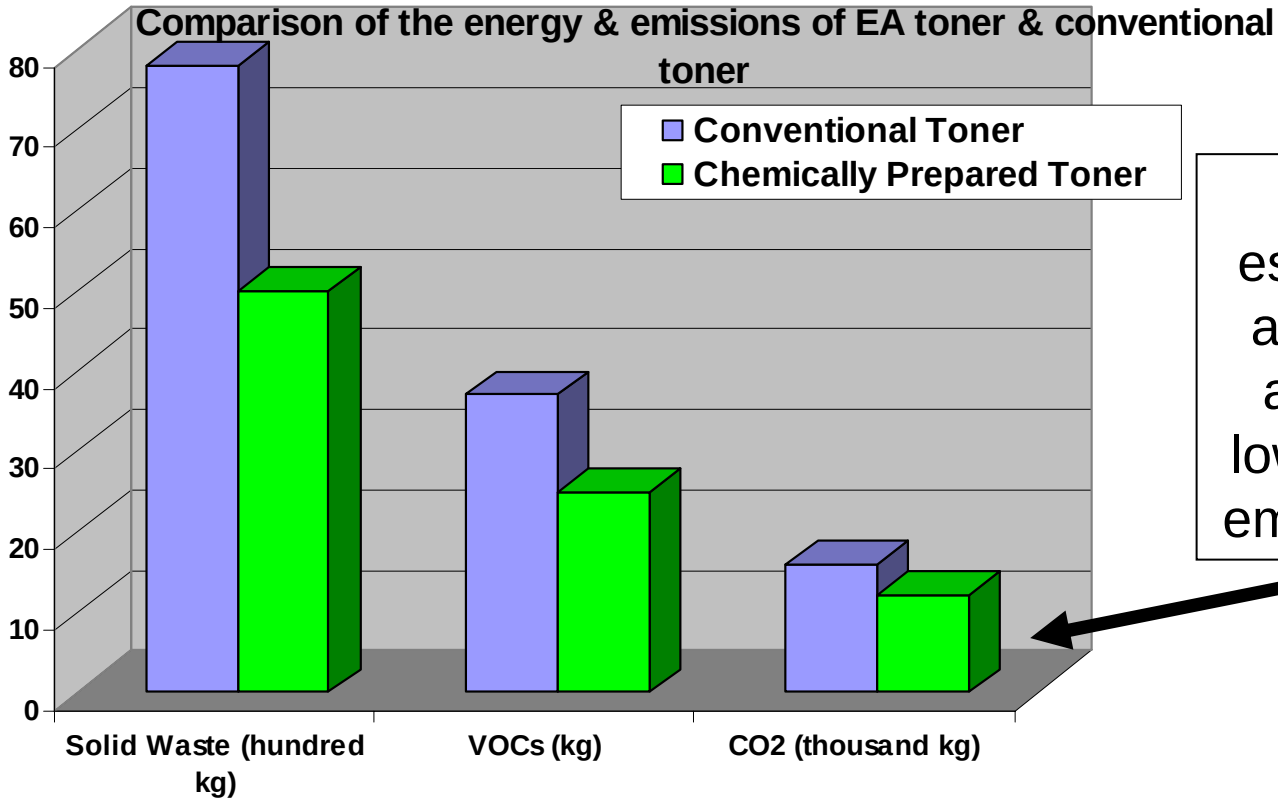
32% Less VOC's!

LGA!!!!

Per metric ton of toner produced and used.

Source: Ahamadi, A, et al, Life-cycle inventory of toner produced for xerographic processes, J Cleaner Production, 2001

CHEMICAL TONER IS MORE GREEN!



Some estimates as much as 35% lower CO_2 emissions*

Per metric ton of toner produced and used.

* Kiyono, Eiko. EA Process Technology, http://www.fujixerox.co.jp/eng/company/technical/interview/ea/index.html

Source: Ahamadi, A, et al, Life-cycle inventory of toner produced for xerographic processes, J Cleaner Production, 2001

CHEMICAL TONER IS MORE GREEN!

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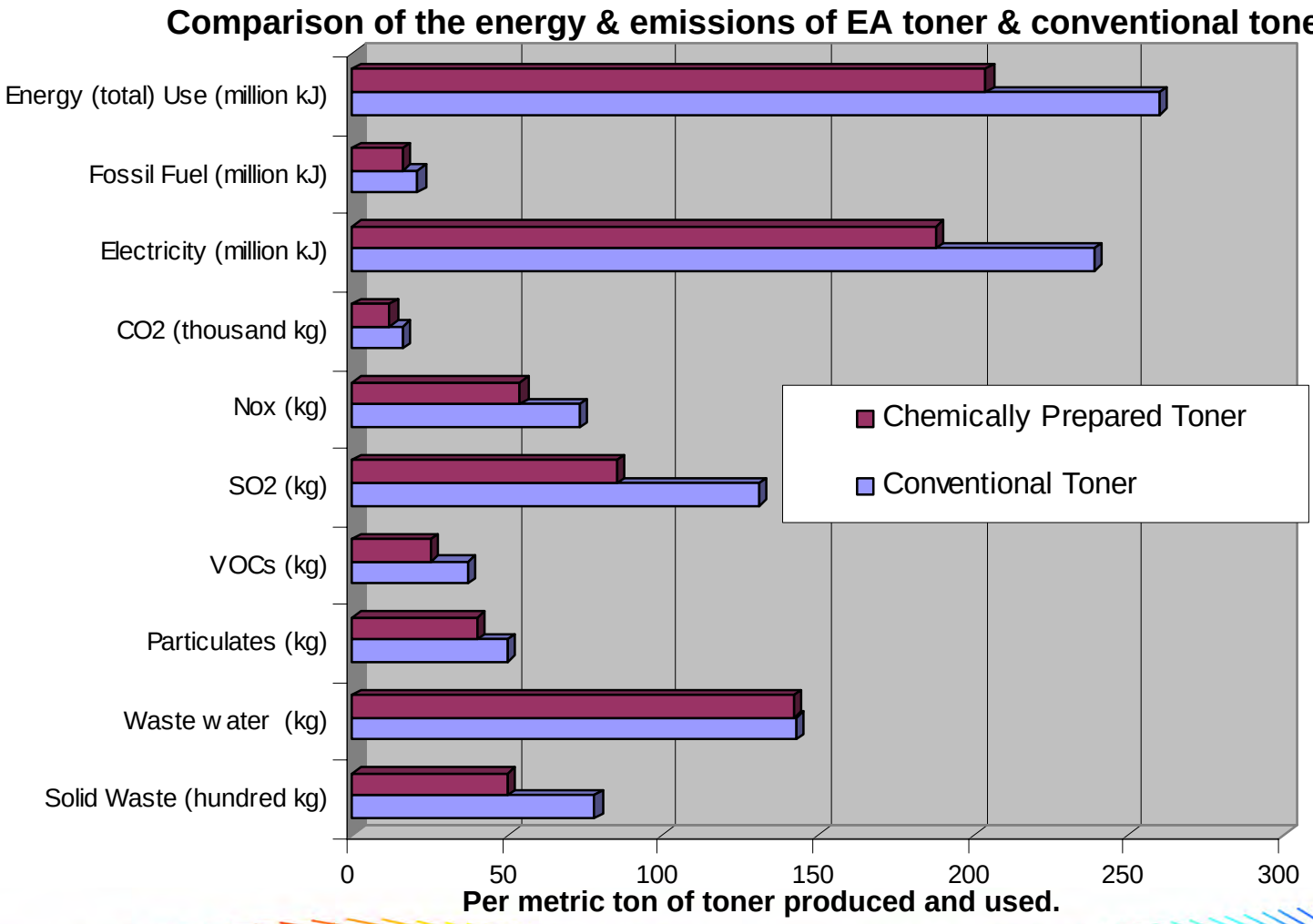

Source: Ahamadi, A, et al, Life-cycle inventory of toner produced for xerographic processes, J Cleaner Production, 2001

The Future

- **Why the OEMs are turning to CPT**
  - **In order to print at 600 DPI, the toner size must be about 6-8 microns. To print at 1200 DPI, control of particle size and shape is critical – this is virtually impossible with conventional toner. CPT is more consistent – consistent particle size and shape equals consistent charging properties.**
  - **V.O.C.s**
  - **Fusing – Encapsulation permits good fusing at low energy levels**

HP OEM Toner

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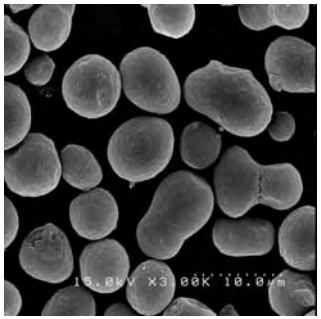
S-Toner™



HP4500

Release 1998

Speed (C/B)
4/16ppm
(4-cycle)

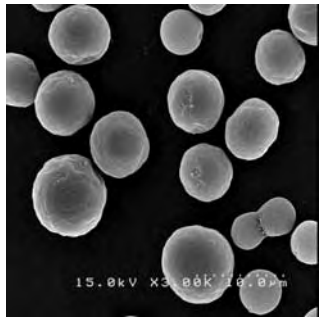
W.U. Speed
250sec
(Halogen)

HP4500 Toner Analysis

D50 vol. : 7.3um
<5 pop. : 13%
Circularity : 0.975
Sp : 137deg-C

Low Gloss
Poor Fixation
Low Q/M

New S-Toner™



HP4600

Release 2002

Speed (C/B)
17/17ppm
(Tandem)

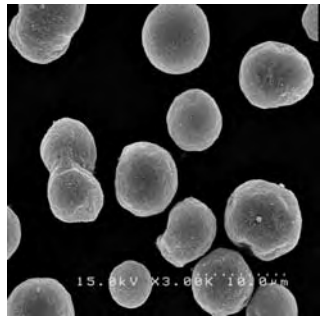
W.U. Speed
29sec
(IH)

HP4600 Toner Analysis

D50 vol. : 6.6um
<5 pop. : 22%
Circularity : 0.974
Sp : 123deg-C

Low Gloss
Good Fixation
High Q/M

Color Sphere™



HP4700

Release 2005

Speed (C/B)
31/31ppm
(Tandem)

W.U. Speed
0sec
(Ceramic)

HP4700 Toner Analysis

D50 vol. : 6.9um
<5 pop. : 22%
Circularity : 0.978
Sp : 119deg-C

Middle Gloss
Good Fixation
High Q/M

The Future

- **Why the OEMs are turning to CPT**
  - **In order to print at 600 DPI, the toner size must be about 6-8 microns. To print at 1200 DPI, control of particle size and shape is critical – this is virtually impossible with conventional toner. CPT is more consistent – consistent particle size and shape equals consistent charging properties.**
  - **V.O.C.s**
  - **Fusing – Encapsulation permits good fusing at low energy levels**

- **Which OEMs use CPT**
  - **All major LBP OEMs!**
- **Monochrome CPT!**
  - **It's been around for years! The first CPT was made for monochrome!**
- **Why the Aftermarket is clinging to Conventional**
  - **Cost of Technology (like the cost of failure!)**
  - **Water Treatment**
  - **Intellectual Property**
  - **Inertia**

So Why Use Chemically Produced Toner?

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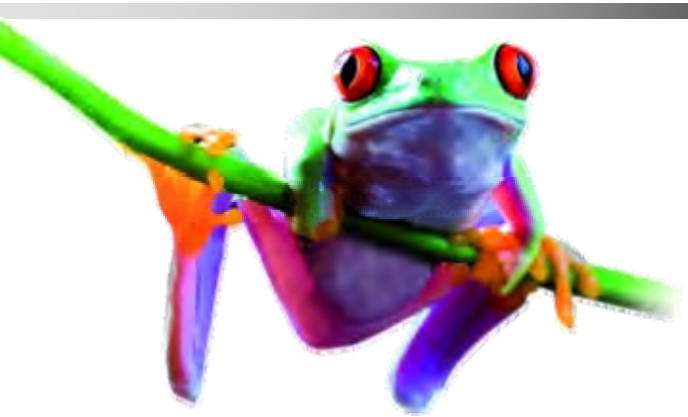
- **Quality**
- **True Cost**
- **The Future**



QUESTIONS AND ANSWERS