Powder Coating and Printing on Metal with Electrophotographic Technology

Eric Stelter, Patrick Lambert, Joseph Guth, Vern Lincoln, Bret Johnston, and Michael Frauens; Eastman Kodak Company; Rochester, NY/USA

Abstract

Electrophotographic technology can be used for powder coating and printing on a variety of substrates, including metal. Advantages include: better uniformity and thinner coatings than conventional powder coating; the ability to prime, print colors, topcoat, and cure in a single pass through a curing system; the ability to use higher coating speeds than are generally used with liquids; reduced emissions of volatile organic compounds (VOCs); as well as reduced drying, curing, maintenance, and capital costs. This technology also enables production of nanocoatings and composite coatings with enhanced properties, such as improved chip and scratch resistance, chemical resistance, and heat resistance.

Poster Presentation

Value Proposition: Lower cost and equivalent or improved performance for conventional coatings, nanocoatings

- Better uniformity, thinner coatings than conventional powder coating
- Higher coating speeds than used with liquids
- Reduced drying, curing, maintenance, capital costs
- Reduced environmental costs (> $120M/yr in US for cans alone). Reduced VOC emissions

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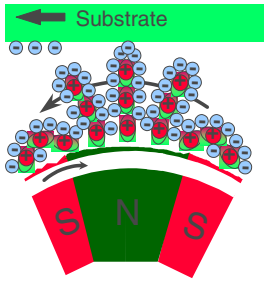
Direct Application of Powder Coatings to Metal Substrate with Rotating Magnetic Brush

- Magnetic carrier particles form a brush on the development roller.
- The powder (–) is attracted to the carrier particles (+).
- The rotation of the outer roller and the magnetic core impart motion to the chains of developer.
- Bias voltage applied to metallic shell moves powder to substrate.



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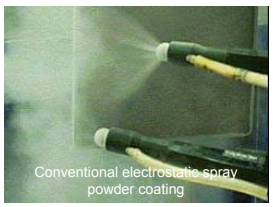
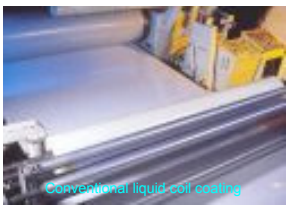
Idea: Apply powders electrographically as an alternative to solvent coating or conventional electrostatic spray powder coating.

Protective coatings

- **Coils (rolls and sheeting), cans, architectural panels**





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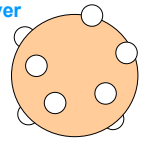
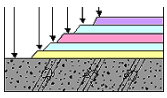
Application: Nanocoatings and composite coatings with significant performance improvements over conventional coatings

- Nanoparticles for functional coatings can be dispersed in powder material or applied to powder particles as a surface treatment, as shown at right (patent pending).
- Small size of nanocoated, electrographically applied powder particles produces a high-quality composite material with good uniformity of nanoparticles after fixing, fusing, or heat treating.
- Composite coatings with multiple thin layers can be made due to small size of electrographically applied powder particles.
- Multiple layer coatings can be cured in a single pass through an oven or curing system.



Applications include: improved chip and scratch resistance, chemical and heat resistance



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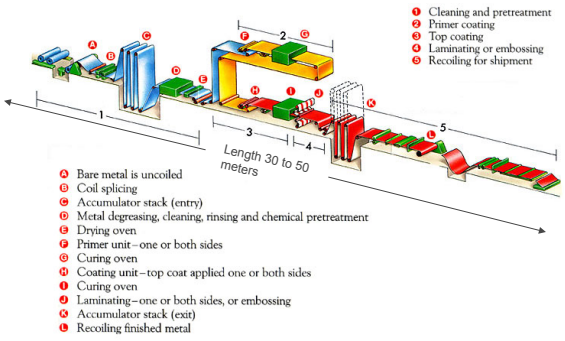
Conventional Coil Coating Line



Source: www.coilcoating.org (National Coil Coating Association)

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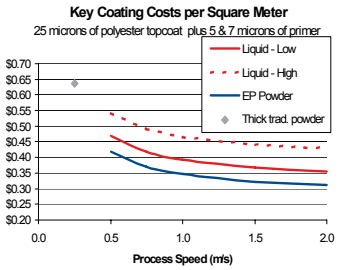
Why the market will want to use our capability for powder coating…

Cost
…TCO curve

Environmental Advantages
… 30% of manufacturing maintenance and plant capital expenditures spent on environmental control[1]

… accelerated effects if adopted as MCAT

Featuring & Capability
… matte finishes, perforated and textured surfaces, some performance advantages



1 http://www.coilcoating.org/why/consider.cfm?CFID=2217799&CFTOKEN=65542148

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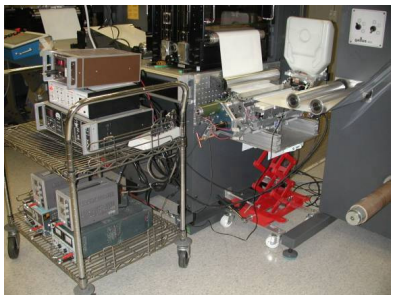
Magnetic Brush Coating Process: Experimental Equipment

- Metallic substrate
- Coating apparatus with magnetic rollers and drive motors
- Power supplies for bias voltage to roller
- Motors and motor speed controllers
- Powder reservoir and feed mechanism
- Powder: Reprocessed and modified commercial polyester powder paint



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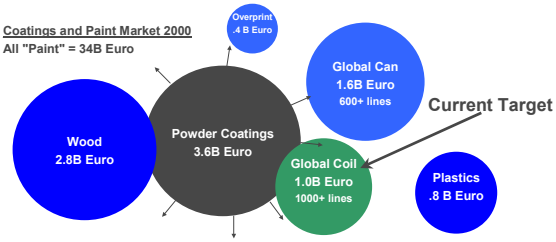
Business Opportunity Dynamics



- **Growth of the coil and the powder markets historically exceeds GDP growth.**
- **Market share growth is due to environmental and workflow advantages.**

Source: DSM Resins

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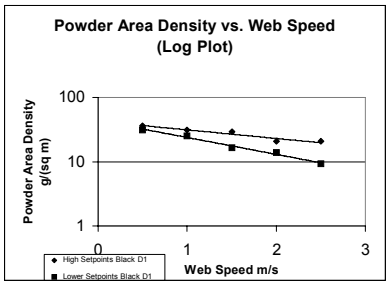
Deposition Rates

- Deposition of powder with rotating magnetic brush has exponential behavior.
- Extrapolation to high speeds is straightforward.
- Powder area density can be increased by increasing bias voltage applied to magnetic brush.



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Author Biography

Dr. Eric Stelter works on electrographic development and related technology at Eastman Kodak, where he is a Senior Scientist in Advanced Development for the Graphic Communications Group. He has been granted more than 35 patents in this field. He began his career at Eastman Kodak Company after receiving his Ph.D. in physics from the University of Illinois. He is an active member of IS&T, the American Physical Society, and the American Association for the Advancement of Science.