VINYL ACETATE - ETHYLENE COPOLYMER DISPERSIONS
IDEAL BINDERS FOR ENVIRONMENTALLY FRIENDLY PAINTS -
STATE OF THE ART TRENDS

Dr. Wilfried Huster, WACKER POLYMERS, 23 February 2011
AGENDA

• Who are we?
• Raw materials and manufacturing process
• VAE copolymer Dispersions are the preferred technology for environmentally friendly paints in Europe
  • Trends
  • Requirements / Eco-labels
  • Sustainability / Renewable Raw Materials
Founded in 1914 by Dr. Alexander Wacker
Headquartered in Munich

WACKER Group (2009)
• Sales: €3.72 billion
• EBITDA: €607 million
• R&D: €164 million
• Investments: €740 million
• Employees: 15,618
WACKER OWNS MORE THAN 50% OF THE WORLD’S VAE TECHNOLOGY PRODUCTION CAPACITY

WACKER POLYMERS production set up

Key Markets

Ethylene

Acetic Acid

VAE

Dispersion

Powders

VAM

Production Powder

Production Dispersion

Technical Center

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VAE TECHNOLOGY
RAW MATERIALS & PRODUCTION PROCESS

CREATING TOMORROW'S SOLUTIONS
EMULSION POLYMERIZATION PROCESS

• Monomers, surfactants / stabilizers, and water are the main components of the vinyl acetate - ethylene copolymer dispersions

• Functional monomers can be added for a variety of purposes, including stabilization or crosslinking

• pH and buffers are important variables in emulsion polymerization, influencing both kinetics and stability

• Additives like defoamers and biocides have specific functions, and are used in small quantities bearbeiten

  • The right choice and amount are critical for handling and the final performance
• The process and apparatus used depend on the kind of monomers
  • Ethylene → gas
  • Open vessel does not work → Autoclave
  • Apparatus is under ethylene pressure

• Vinyl acetate - ethylene copolymer dispersions (VAEs) are sometimes also called “pressure polymers”

• Removal of the residual monomers and other volatile ingredients

• Removal of the residual monomers and other volatile ingredients by different chemical and/or physical measures
VAE COPOLYMER DISPERSIONS ARE THE PREFERRED TECHNOLOGY FOR ENVIRONMENTALLY FRIENDLY PAINTS

CREATING TOMORROW'S SOLUTIONS
VAE COPOLYMER DISPERSIONS – APPLICATIONS

- All kinds of interior applications: (with exception of silicate systems)
  - Solvent-free and plasticizer-free interior paints
    - Matt paints (wall and ceiling paints)
    - Glossy paints
    - Latex paints
    - Silicone paints
    - Matt and glossy full-shade paints
- Interior plasters
  - Scratched plasters
  - Plasters with a worm structure
  - Textured coatings
- Primers
- Fillers
- Glue for glass, fabrics, and wallpapers
Influence of vinylic comonomers on glass transition temperature of vinyl acetate copolymers

Ethylene is the ideal internal softener for vinyl acetate polymer dispersions!

Source: Wacker Chemie AG
MINIMUM FILM FORMING TEMPERATURE (MFFT)

- The process of film formation only occurs over a defined temperature. This temperature is called “minimum film forming temperature.”
  - Above this temperature, the dispersion builds a homogeneous, crack-free film
- The MFFT depends on
  - Tg of the polymer
  - Polymer type
  - Coalescing agents
VAE COPOLYMER DISPERSIONS HAVE OUTSTANDING COALESGING PROPERTIES

Tg / MFFT correlation

MFFT [°C]

Source: Wacker Chemie AG
In VAE, water functions as a coalescing aid (hydroplastification!)

- High scrub resistance
- No additional coalescing agent
- No migration (no fogging)
- Film formation at low temperatures (<5 °C)
TREND
ENVIRONMENTALLY FRIENDLY INTERIOR PAINTS

• Many different regulations to limit VOC in architectural coatings (governmental / labeling)
  • Blue Angel / TÜV-Siegel / EU Ecolabel / VOC Decopaint Directive
• Indoor air quality (dangerous substances – construction products directive CPD) / SREP for interior wall paints
• Manufacturing without APEO’s
• Low-Formaldehyde (<10 ppm)
• Odorless
• Free of sensitizing additives (CIT …)
• What is next?
Ground-level ozone → summer smog

NOx → UV → VOC
WHERE ARE WE HEADING TO?

Evolution of VOC Reduction of Architectural Coatings

VOC (g/l)

State of the Art EU – Global Perspective

State of the Art USA

Low Odor?

Source: Wacker Chemie AG
• Modern low VOC paints contain no solvents or plasticizers

• Therefore no fogging of active substances like solvents or plasticizers

• No black precipitations

Source: Wacker Chemie AG
CHALLENGES

• Rising crude oil prices / energy prices
  • Raw material availability

• Value of sustainability is recognized in the coatings industries
  • Interior wall paints are recognized as the most suited segment for renewable raw materials (IRA report 2009)
Sustainable development is to meet the needs of present generations without jeopardizing the ability of future generations to meet their own needs (source: EU).

- Topics for decorative coatings
  - VOC reduction / co-solvents
  - Low formaldehyde
  - APEO absence
  - Low energy consumption
  - Low carbon footprint
  - Higher efficiency (less binder)
  - Longer lifetimes
  - Eco-friendly packaging
  - Renewable raw materials

The aim is to balance economic, environmental and social goals.

Since 1999: Dow Jones Sustainability Index
IMPACT OF RISING OIL PRICES ON MANUFACTURING COSTS OF POLYMER DISPERSIONS

Gross energy required to produce 1 kg (solids) of polymer dispersions

Source: CEFIC April 2000
IMPACT OF RISING OIL PRICES ON MANUFACTURING COSTS OF POLYMER DISPERSIONS

Cost comparison – relative cost advantages

- O-Content: 35-0%
- No. Synthesis Steps: 4-10%
- Energy Consumption / step: 1-10%
- Process yield / byproducts: 1-10%

Source: Wacker Chemie AG

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Wacker Eyes Green Polymers Production

10:09 AM EDT | April 9, 2010 | Natasha Alperowicz in Burghausen

Wacker Chemie is developing renewable bio-based technologies to produce vinyl acetate monomer (VAM) and ethylene vinyl acetate (EVA) precursors, and ultimately green polymers. The company is the leading producer of VAM-based dispersible polymer powders and a leading maker of EVA-based dispersions. Fridolin Stary, senior v.p./corporate R&D, said at a recent press briefing at Burghausen, Germany—Wacker’s main manufacturing site—that Wacker has been operating a bioethanol-based pilot plant producing acetic acid at Burghausen since last year and is ready to scale up the process as soon as the economics prove viable. The size and timing of the scale up would depend on the price of bioethanol compared with the price of petrochemical feedstock, Stary says. The company is also preparing to produce bioethylene. “We would use some of the quantities of the feedstocks to produce green VAM, and from this green polymers, but so far we have no timeline by when this would be achieved,” Stary says.

Stary: Assessing the economics but no firm timeline is set.

Wacker buys bioethanol from a local distillery, which it uses at the 500-m.t./year acetic acid pilot plant. “We are ready to build an industrial plant but are waiting to assess whether the economics to produce biogenic acetic acid on an industrial scale are justified,” Stary says. No decision has been made on the capacity of the bigger plant but sources say that it could be about 10,000 m.t./year. Wacker would be willing to license the acetic acid process to third parties, he says.

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POSSIBLE WACKER-BIO-ROUTE
ETHANOL HAS A MILLENNIUM LONG PROVEN HISTORY
OF INCREDIBLE DIVERSITY AND PERSISTENT INNOVATION

Cellulose
Corn
Cane

Ethanol
- Water
Ethylene
+ Oxygen
Vinegar

Ethylene
VAM
VAE

end use

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THANK YOU!!