AVEKA Group

PARTICLE PROCESSING SERVICES
TOLL MANUFACTURING
RESEARCH & DEVELOPMENT
INNOVATIVE SOLUTIONS

WILLIE HENDRICKSON, CEO & FOUNDER
AVEKA Group Overview

- Particle technology company focused on contract manufacturing
- Spin-off of 3M in 1994
- Comprised of 5 separate companies
- ISO certifications / food-grade certifications
- Currently 230 employees
AVEKA’s Vision
be the recognized leader in innovative manufacturing solutions for particle technology

AVEKA’s Mission
be the leader in particle processing by providing our customers with custom solutions, quality manufacturing and excellent customer service
Specialty Materials Processing

- Liquid slurry receiving
- Filter press concentration
- Fluid bed drying
- Vacuum packaging
Specialty Materials Processing

Breaking ground to production
• 18 weeks
• MCC Room
• Liquid receiving bay
• Processer Room
• Equipment install and qualification
  • 4,250 kg fluid beds
  • Filter press
  • Extruder
  • Packaging
Particle Drying Services

- Spray drying
- Fluidized bed drying
- Roll drying / drum drying
- Tray drying
**Fires During Processing**

**Problem:**
- Provide encapsulated Omega-3
- Omega-3 very sensitive to oxidation
- Spray drying Omega-3 can cause dryer fires

**Solution:**
- Minimize exposure to air
- Larger particle size
- Roll drying vs. spray drying
# The AVEKA Group

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Particle Characterization

Particle size analysis
- Particles 1 nm to 2+ mm
- Particle size distribution (PSD)
- Sonic sieving
- Rototap

Imaging
- Optical microscopy
- Scanning electron microscopy (SEM)

Surface area analysis

True density analysis
- Helium pycnometry

Formulation analysis
- High performance liquid chromatography (HPLC)
- Thermogravimetric analysis (TGA)
- Spectrophotometer
- Differential scanning calorimetry (DSC)

Flow characteristics
- Zeta potential analysis (ZP)
- Rheological analysis
- Moisture and solids analysis (MSA)
- Karl Fisher
Crushing Line

- Komar Industries auger crusher
- Tote tipper feeder
- Pneumatic conveying to screener
Crushing and Grinding Optimization

- 2003, $D_{50} = 15\text{-}35 \, \mu m$
- 2006, $D_{50} = 18\text{-}24 \, \mu m$
- 2013, $D_{50} = 16\text{-}19 \, \mu m$
- 2014, $D_{50} = 17\text{-}19 \, \mu m$

In 2012, seasonal cyclic behavior of PSD was noted and a customer/AVEKA DMAIC initiated
**DMAIC Results and Questions**

- PSD results ($D_{50} = 15-35 \mu m \rightarrow 16-19 \mu m$) realized by adding proprietary grinding aid

- This proprietary addition not sufficient for total PSD control

- Control of ball mill temperature as critical as proprietary addition
Quality, R&D, Engineering

Fast Implementation, New Processing Questions, Quality Products

- **Quality**: ISO / GFSI - 11 Quality Personnel
- **R&D**: 7 Laboratories / Pilot Plants - 15 Scientists and Technicians
- **Engineering**: Rapid Innovative Solutions - 10 Engineers
Dry Grinding

- Pre-crushing
  - Jaw crushing
  - Auger crushing
- Hammer milling
- Cryo milling
- Ball milling
- Jet milling
AVEKA CCE Technologies

- Fluid bed jet milling
- High-efficiency centrifugal air classifiers
- Equipment sales & service
- Toll processing
Jet Milling Glass

Challenge:
- Produce high yield
- Tight cut from crushed glass

Problems:
- Fines stick to coarse particles
- Yields are low (42%)

Solution:
- Balance input energy and cut points
- Increase yield (54%)
Processing Technologies

- Spray Drying
- Grinding Milling
- Classification / Screening
- Blending
- Roll Drying
- Fluidized Bed Drying
- Prilling
- Particle Coating
- Microencapsulation / Bead Making
- Extraction
- Purification
- Microfiltration / Nanofiltration
Microencapsulation Methods and Capsule Types

Payload Types: fragrances, oils, dyes, drugs, food additives, inks, ...

Core-shell
- Spray drying
- Coacervation
- Tablet coating
- Wurster coating
- Coaxial extrusion

Matrix
- Prilling
- Organogels
- Precipitation
- Emulsion polymerization

Plating
- Incipient wetness
- MAIC
MAIC: Magnetically Assisted Impact Coating

Particle Surface Treatment:
- Add flow agents (silica)
- Coat with solids (TiO$_2$, ZnO)
- Distribute liquids (silanes)
  - US Patent 5,962,082
- Can be used for many applications and industries
  - Agriculture materials, cosmetics, pigments, catalysts
Particles to be modified
- Modifying material

MAIC Unit
Magnetically Assisted Impact Coating

- Feed system
- Screens and magnets
- Magnetic coils
- Coated particles
MAIC: Magnetically Assisted Impact Coating

before MAIC treatment

30 µm

30 µm

after MAIC treatment

100 µm

40 µm

After MAIC Treatment

Add surface functionality with solids or liquids
"The AVEKA Advantage"

- Wide range of process capabilities
- Innovative solutions R&D Engineering
- Strong quality system
- Excellent customer service Partnering approach
- Commitment to health, safety & environmental
- Flexible approaches
Summary

• Innovative manufacturing solutions
• Unique perspective – diverse markets
• Novel particle technology

Email → aveka@aveka.com
Call → (651) 730-1729

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