ENABLING NEXT-GENERATION NANO PRODUCTS
Through Rapid Prototyping and Scale-up of Nanoparticle Coatings

ROLL-TO-ROLL COATING

High-Precision Process
Higher Yield, Lower System Cost

THESIS: ONE HIGH-SPEED, HIGH-PRECISION, ECONOMIC PROCESS FOR NANosciences

Commercial products empowered by nanoparticle technology are showing high growth rates and are proliferating in new products. Nanoparticle-manufacturing processes – from production to dispersion to integration of nanoparticles into products and beyond – involve an interesting mixture of new and old technologies. While there are several methods for incorporating nanoparticles into products, high-precision, roll-to-roll nanoparticle solution coating is often useful as an efficient, cost-effective approach for many products. Some examples are discussed below. Successful nanoparticle coating solutions require an understanding of the geometry and scale of nanoparticles, as well as how they behave in a coating environment.

CARESTREAM CONTRACT MANUFACTURING: Applying Proven Process Knowledge to Solve Nanoparticle Challenges

While nanotechnology is a new concept to many, Carestream has been dealing with nano-scale silver for over 100 years. Carestream grew out of 3M and Eastman Kodak Company, two pioneers that made precision, high-performance medical and photographic imaging films possible. The silver-based technology that works so well for a-ray, magnetic resonance imaging (MRI), computed tomography (CT), mammography and other modalities provided Carestream with a natural starting point for creating nanoparticle transparent conductive films.

Today, we apply our proven process knowledge, experience and quality-driven practices to solve the unique challenges of nanoparticle coatings. Carestream Contract Manufacturing delivers problem-solving expertise for high-precision, roll-to-roll, multi-layer coating, combined with exceptional rapid prototyping capabilities, to help customers take their nanotechnology products from benchtop to pilot to production quickly and efficiently.

We are able to rapidly prototype using our “Whiteboard to Benchtop to Pilot Coater to Full Scale Production” process – something we have done cost effectively for thousands of coating solutions and products.

RAPID PROTOTYPING AND SCALE-UP OF NANOPARTICLE COATINGS

High-demand nanoparticle applications require efficient scale-up from initial concept to full-scale production. A well-conceived rapid prototyping process can identify design and manufacturability issues early in the product development phase – saving time and money. Rapid prototyping and scale-up for nanoparticle-coated products requires:

- Materials Understanding & Design
  - Rheology of the solution — Newtonian, shear thinning/thickening, thixotropic, rheopict
  - Choice of binders, solvents, colloid dispersions, surfactants
  - Interactions with film support, need for surface treatments and/or surface active materials, process aids
  - Environmental interactions

- Appropriate Solution Making & Delivery Techniques
  - Homogenization, mixing, scale-up for lab to pilot to manufacturing
  - Temperature, de-aeration, hold times
  - Filtration
  - Shelf life considerations

- Choice of Coating/Patterning Method(s) & Pilot Scale-up
  - Resolution and registration
  - Waste vs. cost
  - Choice of multi-head or tandem coating station methods

- Multi-Layer Strategy
  - Reduced cost through fewer machine passes
  - Enhanced overall process efficiency

- Establish Continuous Manufacturing Process Conditions
  - Temperature, humidity and time
  - Dry and/or UV curing process
  - Molecular orientations required
  - Single pass vs. multiple pass — interleaves for protection, cleanliness and other metrics
  - Cleanliness and electrostatic control

- Converting & Packaging
  - Final product or intermediate step to finished product
  - Slitting and/or sheeting
  - Sensitivity to dust, propensity to scratch and other quality considerations
  - Package needs, such as gas or water barrier and anti-static materials
  - Hold times prior to next steps
  - Storage and packaging condition

To learn more about our roll-to-roll nanoparticle solution coating capabilities, please contact: info@tollcoating.com or visit www.tollcoating.com.