Production of Dense and Uniform Nanoparticle Films

Auburn University is seeking licensees for a technique to create highly uniform and dense nanoparticle films.

Overview: This novel technique utilizes CO\textsubscript{2} as an antisolvent and allows for controlled deposition of particles, resulting in more consistent nanoparticle thin films with fewer defects than films made using standard solvent evaporation techniques. This technology has applications in optical devices, sensors, catalysis and semiconductors.

Advantages:
- **BETTER OUTPUT** - Deposits dense, uniform, intact nanoparticle films on surfaces
- **TUNABLE** - Allows for control of film density, quality, spacing and ordering by manipulating such parameters as particle size, particle polydispersity and system pressure
- **FASTER AND CHEAPER** - Reduces post-processing time and cost via simple and effective particle cleaning and solvent recovery
- **BROADER USE** - Uses moderate temperatures, allowing for film deposition on materials incompatible with CVD
- **GREENER** - Reduces environmental impact through use of CO\textsubscript{2} as the anti-solvent and resultant simple solvent recycle

Description: A major thrust of research is currently focused on post-synthesis nanoparticle manipulation for application in such fields as catalysis, optical systems, electronic devices, and sensors. Full utilization of nanoparticles for these applications requires the ability to effectively process and maneuver particles onto surfaces. Such deposition is typically performed by evaporating a liquid solvent containing dispersed nanoparticles. This method, however, can give rise to undesirable features in the film due to surface tensions in the liquid/vapor interface that moves across the surface during evaporation.

In Auburn’s novel process, CO\textsubscript{2} is introduced into the system to form a gas-expanded liquid that results in nanoparticle precipitation and deposition. Additional CO\textsubscript{2} is then pumped into the system until the original solvent is removed, at which point the pressure is lowered to release the CO\textsubscript{2} without causing the typical defects caused by evaporation. This method is simple, efficient, allows for easy solvent recycle, and leaves no residual liquid solvent.

Status:
- This invention has been successfully verified by laboratory experiment with various ligand-coated metallic nanoparticles.
- US Patent 7,384,879
- This patent is available for immediate nonexclusive licensing through Auburn’s customizable “Ready to Sign” licensing program.
- Similar patents available for Nanoparticle Technologies, including a companion technology that fractionates nanoparticles by size with less time and cost than existing methods