

## The CHEMunicator

The Official Newsletter of the Rochester, NY Section of the  
American Chemical Society

May 2009

*Focus on Rochester Section Technology - Innovation Through Chemistry*

### **Company: Cerion Technology, Inc.**

**Product / Technology:** Proprietary processes for large scale manufacture of nanophase oxides - powders and dispersions  
Applications in transportation, energy, catalysis and pharmaceutical industries

**Web Site:** [www.ceriontechnologies.com](http://www.ceriontechnologies.com)

**Address:** 1 Blossom Road, Rochester, NY 14610

**President:** Mr. Mick Stadler

**CTO:** Dr. Kenneth Reed

**Company Technical Areas:** Nanophase oxides, colloid chemistry, surfactants, chemical process engineering

**Number of Employees:** 9

Cerion Technologies is a materials science company whose core competence is the aqueous precipitation and functionalization of inorganic nanoparticles for applications in catalysis, power generation (fuel cells), and therapeutics. The company, founded in March, 2006, was spun out of RIT's business incubator, Venture Creations. A subsidiary, Cerion Energy, Inc., was formed in February, 2007 to commercialize nanophase oxide materials for application as diesel engine fuel borne-additives to improve combustion, with resultant increased fuel economy and reduced green house gas emissions. The technology team is led by Ken Reed, who worked at the Kodak Research Laboratories for 30 years before joining Cerion as CTO. His prior work at Kodak in silver halide technology, the first and highest volume commercial application of nanophase materials (i.e., nanocrystals of silver halides as light capture and amplification elements in conventional

photography) provided him with a fitting technical background for his new company. Ken received his B.Sc. in Chemistry from RIT and his Ph.D. in Physical Chemistry from Stanford University before joining the Kodak Research Laboratories in 1975. His work at Kodak centered on both fundamental investigations of the preparation, characterization and photophysics of silver halide nanocrystals, as well as their incorporation and performance in commercial photographic film. His 30 year career at Kodak involved applied precipitation research for both novel and conventional silver halide crystals, and redox mechanisms related to their development processes. This led to 20 patents in such areas as direct band gap crystal detectors, novel epitaxial and laminar nanocrystals, two electron reducing agents and novel heterocyclic adsorbates. His later work focused on developing patent and technical strategies for the generation and use of monodispersed organic nanoparticles for OLED applications. Ken is also a longtime member of the Rochester Section of the ACS.

The commercialization and general business efforts at Cerion are led by Mick Stadler, the Chairman and CEO. Mick holds a B.S. in biology and chemistry and an M.S. in physics from John Carroll University. He is also a Registered Patent Agent. With an extensive background as an entrepreneur and in technology transfer, he has been involved in establishing and financing more than 60 university-affiliated companies. Prior to starting Cerion, he was the Executive Director of the Rochester Institute of Technology's Center for Entrepreneurship and its Technology Incubator - Venture Creations. Before joining RIT he was the President and Chief Executive Officer of the Vanderbilt University Technology Company (VUTC), Managing Partner of Vanderbilt's Chancellor Fund, and the Founder, Chairman, CEO, and President of Competitive Technologies, Inc., a public company he founded in 1991 which is involved in the commercialization of orphan technologies developed by corporations, universities and federal laboratories. Earlier positions included Executive Vice President and COO of Research Corporation Technologies (the world's oldest and largest technology transfer organization), a Founder and Chairman of ConduIT Corporation, J International Partners (China), International Diagnostic & Treatment Centers, The Heart Institute of the Caribbean, and Sage Capital.

Cerion's business model is to become the leading supplier of the most value-added nanophase materials for combustion catalysts. In addition to their in-house R&D efforts, Cerion maintains close RIT collaborations, with several faculty members (Professors Hailstone, Langner, Kotlarchyk, and Ogut) with expertise in colloid chemistry, synthesis and characterization of nanosize materials (RIT's NanoImaging Laboratory), and diesel engine technology (Dr. Michael Hazelkorn in the Center for Integrated Manufacturing Studies). The technology required to prepare nanoparticles with precise sizes and dopant level incorporation, using

thermodynamics and kinetic control, was developed, and is still being advanced, through collaborations at RIT.

Pictured below is Cerion's corporate headquarters, located at 1 Blossom Road in Rochester (the former Sydor Optics building).



The main manufacturing facilities (picture below) are housed in Bldg. 35 leased space in Eastman Business Park.



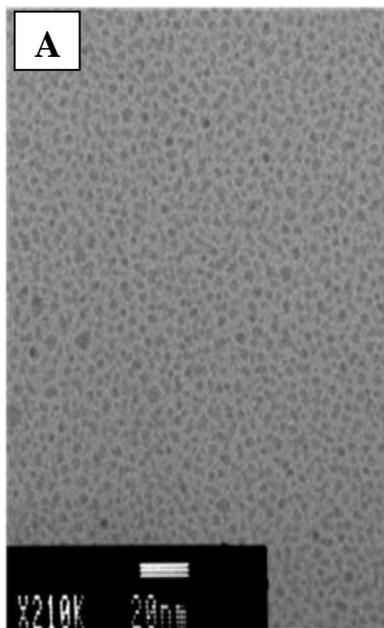
The current three manufacturing bays, one of which is shown below, have the capacity to manufacture 100,000 gallons of fuel additive per month which can treat 400,000,000 gallons of diesel fuel (about 10% of the US monthly consumption). Cerion's process provides an aqueous colloidal dispersion with 20 weight percent of nanophase oxide and has a yield of 90%.



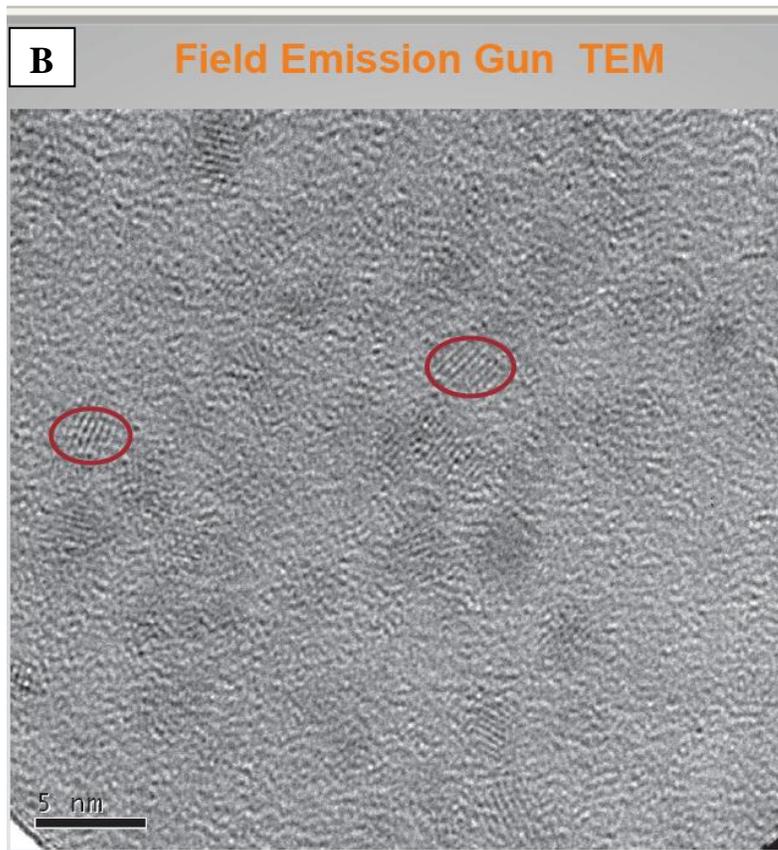
In addition to improving the efficiency of the combustion process and providing fuel economy, the colloidal ceria catalyzes the oxidation of soot and hydrocarbons to  $\text{CO}_2$  and  $\text{H}_2\text{O}$ , providing cleaner diesel exhaust.

Cerion technology can produce stable aqueous dispersions with monodispersed ceria particles in the nanometer size regime, thereby eliminating settling and insuring high surface area for high catalytic activity. The TEM of 2.5 nm ceria, typically used in Cerion's diesel fuel additive product, is shown in **Fig. 1**. Using their proprietary process and surfactant chemistry, ceria particles can, however, be produced with geometric sizes of 1.5-20 nm.

**Fig. 1. A: Transmission Electron Micrograph of 2.5 nm Ceria Particles Produced by Cerion Process for Use as a Diesel Fuel Additive ; B: Lattice Imaging of These Particles**



- Small ~1.5 to 20 nm
- Monodispersed
- High Yield
- Pure
- Low Cost
- Surface functionalized for water or oil dispersions
- Volume Production
- “Lattice” Engineered (i.e. doped) for optimized performance



Energenics, a Singapore-based supplier of alternative energy solutions and technologies, has committed \$500,000 to lead Cerion Energy's \$4,000,000 Series B investment round. Closing of the B Round is scheduled for May 31, 2009. In accordance with a previously executed Memorandum of Understanding, Energenics and Cerion have pooled their R&D expertise to jointly develop a family of "Third-Generation" fuel-borne combustion catalysts which increase fuel efficiency while reducing harmful greenhouse gas emissions and health-threatening chemicals such as NO<sub>x</sub> (N<sub>2</sub>O, NO, and NO<sub>2</sub>) and Diesel Particulate Matter (DPM – particles of elemental carbon with surface adsorbed organics).

Advanced cerium oxide nanoparticles have been developed by Cerion for addition to diesel fuel in the less than 5 parts-per-million range. These catalytic cerium dioxide particles are up to forty times as reactive as existing cerium dioxide nanocatalysts used as fuel additives. The thermodynamic and kinetic properties of Cerion's cerium oxide particles can be independently controlled and engineered down to the limits of particle size reactivity. Cerion has demonstrated unprecedented levels of particle size control and surface activity for use as fuel-borne catalysts.

Formulations are available that combine the properties of Cerion's new cerium oxide particles with the multiple particle effects of Energenics' cerium oxide particles which are supplied to Energenics under an exclusive agreement with Antaria Limited of Perth Australia. These new Third-Generation fuel-borne catalysts are already available in commercial quantities and current manufacturing capacity at Cerion's Rochester, New York plant is sufficient to produce enough additive to treat over 5 billion gallons of diesel fuel annually.

Cerion's marketing and distribution subsidiary, Cerion Gulf, is in the final stages of completing initial field tests with several major potential customers in the Southeast United States. Previous tests conducted by both Energenics and Cerion demonstrated increases in fuel efficiency and reduced emissions. Extensive laboratory engine test data (thousands of hours) and on-road test data (millions of miles) by both Energenics and Cerion demonstrate that these diesel additives increase fuel efficiency by 8-15% while reducing greenhouse gases by up to 15%, NO<sub>x</sub> by 8%, and DPM (soot) by 30-40%. These new additives provide significantly better performance than existing commercially available First-Generation cerium oxide fuel additives.

Current product introductions that involve collaboration with strategic partner Energenics of Singapore include a family of fuel-borne catalysts (in order of increasing efficacy): Enercat<sup>™</sup>, Enercat Plus<sup>™</sup> and Enercat LE<sup>™</sup> a lattice

engineered material. Cerion is currently field testing these products with NOCO (Buffalo), Griffith Energy (Rochester), and in the Gulf of Mexico on push boats and is in discussions with various railroads.

In addition to collaborating on fuel combustion catalysts for diesel, gasoline, ethanol, biodiesel, coal, etc., Energenics and Cerion are exploring business opportunities in the area of cellulosic ethanol production and other areas where their combined technologies can make a major impact on the development of green-alternative energy solutions. Energenics and Cerion are also considering establishing a world-class trading service for Carbon Emission Credits that result from the use of its products in the reduction of transportation-related greenhouse gas emissions, an area that Energenics has been actively involved in for 2 years.

In a relatively short time, through innovation and hard work, Cerion has gone from the concept stage to product development and commercialization of a unique family of nanophase materials. Although we are constantly told that we are in the “digital age”, the success of this new materials-based company and its promising outlook for continued growth is an emphatic reminder that chemistry and materials are, and will remain, the basis of our economic engine. The words of the old DuPont motto – *“better things through chemistry”* – remain true today, with ever increasing control of materials design, synthesis and functionality.

For more information on Cerion visit its WEB site, [www.ceriontechnologies.com](http://www.ceriontechnologies.com). Cerion Technology will also be the featured company at the Rochester ACS Section’s June Networking Mixer at MacGregors (300 Jefferson Road, Henrietta) on Tuesday, June 2, 5-8 p.m. - see the Section website, [www.RochesterACS.org](http://www.RochesterACS.org) for more details).