



# INSIDE R&D ALERT

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Encapsulation for OLEDs**

**Chapter: INCREASING WEAR RESISTANCE**

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## **INCREASING WEAR RESISTANCE**

Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, recently completed characterization studies of a nanofilm coating developed by C<sup>3</sup> International LLC, based in Alpharetta, Georgia. The national laboratory subjected the oxide coating through a variety of grueling tests and found that these proprietary coatings provided substantially greater wear resistance to most components that were tested. This includes field-testing on steel industry rollers, die casting molds used at wheel manufacturing plants, and the blades that cut 11 billion ketchup packets annually. This finding was music to the ears of Mark Deininger, President and CEO of C<sup>3</sup>, whose next steps are to commercialize these rare earth-based coatings.

"C<sup>3</sup>'s technology platform consists of 58 elements, in various combinations, that are formulated to impart a myriad of new properties to the substrates of steel, metal alloys, carbides, glass, ceramic, cermets, and most inorganic materials," explained Deininger, a practicing attorney (Juris Doctorate, University of Georgia School of Law, 1976), with a strong concentration in chemistry during his student years. C<sup>3</sup>'s surface modification is nanoscale in size, economical in application, can often be done on site at relatively low temperatures, and is Environmental Protection Agency-friendly. C<sup>3</sup> applications that have immediate commercial value are patented. Patents include a variety of methods and specially engineered designs for all of C<sup>3</sup>'s new applications.

### **Taking it to the Streets**

"Our mission is to take technology out of the lab and put it on the street--C<sup>3</sup> commercializes its Intellectual Property through license or joint-venture," noted the

company's president and CEO. C<sup>3</sup> often forms alliances with companies already strategically positioned to rapidly roll out C<sup>3</sup>'s technology into its particular market(s). The company's portfolio includes 27 Eastern European technologies that the executive explored through joint venture, one of which was transferred to C<sup>3</sup>, out of more than 3000 technologies developed in Eastern Europe that Deininger reviewed as President and Founder of the Russian American Technology Alliance from 1993 to 1999. Deininger also co-invented five C<sup>3</sup> patents, one issued, and four in process.

The technology platform's prior art was acquired overseas, and subsequently extended by C<sup>3</sup>'s American scientists and engineers, seven of whom are co-inventors on patents pending, issued and in process. The key to the C<sup>3</sup> coating technology is to apply rare-earth and other metal oxide films at low temperature (450 degrees C) in a variety of combinations at the nanoscale. The films bond to most nonorganic surfaces, including carbides, steel, glass, ceramics, cermets, and many metal alloys. The US Department of Energy's Office of FreedomCAR and Vehicle Technologies have provided some of the funding for this research.

Partnering with ORNL gives C<sup>3</sup> needed credibility to commercialize its coatings. "Through ORNL's independent analysis, characterizations and test results, C<sup>3</sup> has been able to partner most of the major partners it chooses to do business with," remarked Deininger, who said the national laboratory began testing the coating technology platform in 2002 and continues to perform ongoing characterizations. "A large number of unsolved problems have been re-mediated by C<sup>3</sup>'s novel, unique and patent pending processes," he said. "C<sup>3</sup>'s platform allows C<sup>3</sup> through applied engineering to solve huge problems that have been plaguing mature industries for decades, for example, aluminum die casting and extrusion, steel forging and rolling, petro-chemical, automotive, and glass products. We are now branching out and creating new frontiers in material science relating to fuel cells, photovoltaics, catalysis, and many more."

The executive compared C<sup>3</sup>'s relationships to building a battle fleet. The company has launched an aircraft carrier (a petrochemical strategic alliance), a battleship (master

license to a major steel manufacturer), a cruiser, and several support craft (aluminum extrusion, die casting, and metal forming clients), and a "boomer" (a fuel cell application about ready for launch). C<sup>3</sup>'s shipyards are its application labs in Atlanta and at ORNL, and its production facility in Muncie, Indiana.

Details: Mark Deininger, President and CEO, C<sup>3</sup> International, LLC, 1370-F Union Hill Industrial Court, Alpharetta, Georgia, 30004. Phone: 678-624-0230. Fax: 678-624-0503. E-mail: [mark.deininger@cccintl.com](mailto:mark.deininger@cccintl.com). URL: [www.cccintl.com](http://www.cccintl.com).