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Terves Inc. - New Powdermet Spin-Out

Powdermet launched its newest spin-out company, Terves Inc., this past spring. Terves manufactures composite materials that are engineered to respond to their environment and are focused on initial applications for unconventional oil completions and enhanced oil recovery.

Terves’ primary advantage is TervAlloy™, which disintegrates into sand-sized particles after a specified time, in response to a controlled environmental stimulus.

Read below for learn more about this exciting technology.

Message from the CEO

2013 has been another exciting year for Powdermet, our sustainable materials solutions and nanomaterials platforms/products. We increased our team with nine new Powdermet employees in a variety of roles—Engineering, Metallurgy and Communications. We’re also excited to announce our Powdermet’s latest spin-out company, Terves Inc., focused on magnesium composites and other nanotech metals for the oil and gas industries. Terves has its first employee and first investors, and we look forward to another home run like our MesoCoat spin-out.

Powdermet has also initiated major funding technology collaborations this past year, including revolutionary efforts with a major oil company to develop specialized nanotech coatings for proppants that can advance enhanced oil recovery of tight formations, a Phase II SBIR investment furthering the development of our record energy-level nanocomposite capacitors, seed investments in hierarchical nanocomposite cermet bearings, and exploratory funding for nanotech membranes that may enable the successful development of safe and powerful magnesium batteries.

The excitement of our clients and colleagues around the potential of Powdermet’s nano-enabled particle technology is truly amazing, and bodes well for the future. The ongoing production of our first- and second-generation engineered particle products is showing increasing demand, and the brand value and reputation of Powdermet and our technologies has never been higher. I look forward to continued collaboration to create value for our shareholders, customers, and communities.

~ Andrew Sherman
Powdermet proudly announces the launch of its newest spin-out company, Terves Inc. Established in May 2013, Terves is focused on developing and manufacturing nano-composite metals that are designed to respond to their environment to do more. The first generation of these multifunctional nanomets focuses on unconventional oil completion and enhanced oil recovery applications.

Terves' first product is TervAlloy™, an engineered nanocomposite metal that disintegrates into sand-sized particles, in response to an environmental stimulus such as temperature, electric current or pH, eliminating time/costs for drill-out and well clean-up in frac-balls, seats, perforators, packers, and other completion equipment. TervAlloy™ has the potential to reduce well completion times up to 50% for multistage hydraulic well completions, saving our clients hundreds of thousands of dollars and reducing environmental impact and water usage of oil/gas extraction operations.

Watch for the Terves NanoMatters newsletter in your inbox soon for further information or contact General Manager Brian Doud at bdoud@tervesinc.com or 216-404-0053 (ext. 120).

Powdermet Receives 2013 SBIEC Ohio Excellence Award

Powdermet has been selected for the 2013 Ohio Excellence Award amongst all its peers and competitors by the Small Business Institute for Excellence in Commerce (SBIEC).

Each year the SBIEC conducts business surveys and industry research to identify companies that have achieved demonstrable success in their local business environment and industry category. According to the SBIEC, Powdermet has consistently demonstrated a high regard for upholding business ethics and company values. This recognition by SBIEC marks a significant achievement as an emerging leader within the manufacturing sector, and is actively setting benchmarks that the industry should follow.

Visit our website to read the full article.

Partnering with Army & Navy for Technology Maturation
Powdermet Developing Low-Friction Bearings for Navy Aircraft

Powdermet is collaborating with the United States Navy under a Phase I SBIR program to customize and mature our hierarchical nanocomposite cermet materials for mission-critical spherical bearings and roller bearing applications. Each of these efforts serves to modify our R&D 100 award-winning hierarchical nanocomposite cermet materials for production of consolidated bearing components. These materials are also the basis for spin-out Mesocoat’s performance and cost-leading PComP™ nanocomposite thermal spray products, which are commercially manufactured by our Powdermet Powder Production wholly-owned subsidiary and sold exclusively through Mesocoat Inc.

This project has thus far led to production of a fully dense titanium nitride hierarchical nanocomposite bearing that shows no observable wear in both dry and low-lubricating (diesel fuel) conditions up to 7N loads, a feat that is unmatched by other materials. We have also produced a prototype sleeve bearing that demonstrates the manufacturability and machinability to tight tolerances required for commercial introduction. We look forward to further testing and maturation of these bearing products.

We are also working with the Naval Air Research Center in another project; our hierarchical tungsten nanocomposite materials will be modified for molding and tested for application in roller bearings. This development project began this month and investigates the use of novel consolidation methods to produce fully-dense tungsten-carbide nanocomposites suitable for this highly-loaded application. We expect this material, with superb hardness and fracture toughness, will withstand the harsh environments and mechanical stresses encountered in roller-bearing applications and allow for smaller, lighter bearings with significantly higher load-bearing capability to be produced.

Both of these bearing materials are beneficial in a variety of Naval applications, ranging from aircraft wing and rotor applications to the spherical bearing to aircraft electromagnetic launch systems. We also expect them to be useful in commercial applications in the automotive, energy, and aerospace industries.

Powdermet Producing Nanocomposite Dielectrics for High-Energy Density Capacitors

Powdermet has begun developing and producing a record-breaking high-energy density nanocomposite thin film capacitor, with the support of U.S. Army Phase II SBIR funding. The Army intends to use these capacitors to replace existing thermal batteries used in various applications to enable instant-on capabilities in their ordnance systems.

During earlier work, we demonstrated achieving outstanding energy densities through the combination of multifunctional nanoparticle synthesis and the production and testing of capacitor films with energy densities exceeding 20J/cc, compared to current commercial system energy densities of 3 J/cc. Unlike batteries, capacitors charge nearly instantaneously, store large amounts of energy over an extended period of time and instantly discharges with no damage.

Other commercial markets can include high-speed train third-rail dynamic braking power storage/distribution, solar and wind power peak/off-peak storage and delivery and passive power factor correction and harmonic distortion mitigation.
We are really excited about these energy storage products being developed under our ENComP™ energetic nanocomposite product line.

We are excited to add Dr. Haixiong Tang to our engineering team. As a research and development engineer, he is working on this development of high energy density capacitors along with General Manager Brian Doud. For more information about Dr. Tang, see his biography below.

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*Receive Latest News on Powdermet’s State-of-the-Art Technologies*

Visit our Twitter and LinkedIn social media pages and learn about recent Powdermet advancements and marketing efforts.

Along with these updates, we are revitalizing of our monthly *Nanomatters* newsletter, with the assistance of Joyce Ashman.

Joyce joined Powdermet’s staff in July as the company’s Technical Editor and IT Administrator. Her role includes contributing informative news to Powdermet’s social media campaign, editing marketing communications and governmental grant proposals and managing Powdermet’s computers/software and providing technical assistance.

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**Welcome Aboard**

**Dr. Haixiong Tang, Research and Development Engineer**, joined the Powdermet team in September 2013, where he is currently investigating the structural property relations in nanocomposites for energy storage and developing high-energy density capacitors with quick discharge rates. He possesses extensive knowledge in the areas of energy materials, composite materials, nanotechnology, multifunctional materials and advanced ceramic/powder technology.

Dr. Tang received his Ph.D. from University of Florida, and his M.S. and B.S. in Materials Science and Engineering from Harbin Institute Technology in China. He has written 33 technical publications, including 24 journal papers, nine conference proceeding papers and numerous articles in *Nano Letters, Advanced Energy Materials, Nanotechnology* and *Applied Physics* Letters.

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**WHO WE ARE**

The core of Powdermet technology is a hierarchically structured nanocomposites building block platform. Powdermet’s technology is based on the design and production of engineered particle building blocks that incorporate nano-, micro-, and meso-scale structural features engineered into safe, free flowing particle delivery system.

**WHAT WE DO**

These engineered particles incorporate metals, ceramics, and polymers with compositions and phase distributions engineered and controlled on three length scales simultaneously.

**HOW WE DO IT**

Using advanced powder metallurgy and polymer fabrication techniques, these engineered building blocks are turned into components with exceptional levels of performance and value, solving some of the
toughest materials challenges.