Synthesis of Nanomaterials Leads to National Technology Award

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Innovative research in the College of Engineering at the University of Arkansas has led to a local company receiving a national technology award. Frost & Sullivan honored NanoMech LLC for its nanostructured, cubic boron nitride coatings, which are used on cutting tools. The researchers developed the coatings based on a novel electrostatic spray coating process.

NanoMech LLC, a Fayetteville company started four years ago by a UA mechanical engineering professor in partnership with Virtual Incubation Co., a technology venture development firm, is the recipient of Frost & Sullivan's 2005 Award for Excellence in Technology.

Each year, Frost & Sullivan, an international growth-consulting company, presents the award to a company that has pioneered the development and introduction of an innovative technology. The award recognizes development of technology that has affected or has the potential to affect several market sectors and is expected to bring significant contributions to industry in terms of adoption, change, and competitive posture. It also recognizes the company's overall technical excellence and commitment toward technology innovation. Previous honorees of the Frost & Sullivan awards for technology include companies such as Texas Instruments, IBM, W.R. Grace, Lucent Technologies, Sun Microsystems and GE Healthcare.

NanoMech's technique of producing coatings involves the application of cubic boron nitride nanoparticles on carbide cutting tools by spraying the

particles in powder or suspension form under the influence of an electric field. The presence of an electric field aids the formation of a coating of desired thickness.

The particles are charged as they come out of a powder spray gun and are exposed to an electrostatic field. The charged particles then follow the electric field lines toward substrates and arrange themselves in a uniform coating. The spraying process can produce single and multiphase material with the properties that suit abrasive, lubricating, anti-corrosion, super-hydrophobic, optical, electrical and thermal functions.

After the coating is applied, titanium nitride is introduced as a binder using a process known as chemical vapor infiltration, which enables the titanium nitride to infiltrate the porous cubic boron nitride coating. This produces composite coatings that exhibit good adhesion and wear properties. These coatings can also withstand high temperatures associated with high-speed machining of hardened steels.

NanoMech's innovation can enhance the machining productivity for manufacturers that are constantly looking for ways to produce more at lower costs. NanoMech's coated tools perform better than tools that use conventional coatings. The coating may be used in other areas, such as biomedical implants and electronic components.

"NanoMech has successfully developed a unique portfolio of technologies for synthesis of nanomaterials and products coated with nano- and microparticles," said Ajay Malshe, professor of mechanical engineering, adjunct faculty of electrical engineering and NanoMech's co-founder and chief technology officer. "Using University of Arkansas inventions in electric field-assisted and directed assembly of nanoparticles, NanoMech has further developed the ability to design and systematically use nanomaterials for coating new products and

significantly improving functional performance of existing products."

Malshe and William Brown, distinguished professor of electrical engineering, made key scientific and engineering contributions that led to the formation of NanoMech. Malshe said many students, research associates and collaborators also contributed to the research.

Under exclusive license from the university for its many patents, NanoMech was formed to develop and manufacture innovative nanoparticle-based coatings and coating deposition systems. The company's primary focus is applying nanoparticles to a variety of products, including parts with complex, three-dimensional geometries, to produce functional or multi-functional coatings. The applications are used principally in the automotive, aerospace and industrial sectors. NanoMech has received support from federal agencies to improve existing products and create new products that increase manufacturing efficiency and competitiveness and improve quality of life.

Source: University of Arkansas