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COVER PHOTO

Cover Photo courtesy of Scio Diamond Technology and shows a sampling of rough and cut cultured diamonds.

FINER POINTS is the oldest publication devoted exclusively to the understanding, selection and application of diamond, cubic boron nitride and related materials. It is edited for recipients who are involved in some way with these “superabrasives”, either as providers of the materials, producers of products containing the materials or users of these products (e.g., grinding wheels, dressing tools, drill bits, saw blades, sawing wires, cutting tools, polishing compounds, CVD film products, etc.).

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Superabrasive Industry Review
FINER POINTS
At the recent Superhard Materials Conference in Zhengzhou, China, I was asked to speak and give my thoughts on the superabrasive industry, especially as it applies to business between China and the USA. While our two cultures view international business from different perspectives, I felt it was important to give my viewpoints considering the growth and expansion of Chinese companies and their influence around the world in the superabrasive and manufacturing industries. Recent reports have indicated that approximately 90% of all superabrasive raw materials produced globally are manufactured in China. We as the IDA of America may need to consider what role these Chinese companies or any International Member will play in our association in the future.

Here is a portion of the speech I gave to a portion of the almost 1,000 attendees at the conference: "The Industrial Diamond Association of America (IDA) was founded in 1946 long before most international countries even considered getting into the US Manufacturing arena, much less considering diamond as a venture where they might seek opportunities or involvement. In those days the global diamond industry for industrial, or gems for that matter, were natural materials coming from Africa, South America and India. Even in those early days, the first "superabrasives" in the way of natural diamond was represented by the IDA at the beginning of its long and distinguished history in representing the Diamond Industry of North America. Many of our members have evolved from the founding companies who were the pioneers of our industry. In 1946 only natural diamond was available and all of the "superabrasive" tools were made from this abrasive, mainly for grinding carbide and glass. After World War II, it became evident that since natural diamond was a critical material, it was extremely important to the USA to undertake research to manufacture diamond and not rely on other sources for its entire diamond stockpile. In the early 1950’s after much research and development American engineers at General Electric invented the process for producing synthetic diamond. At the same time in Sweden, engineers were also successful in diamond synthesis. There are many IDA members who were pioneers in the early days of synthetic diamond and helped advance the industry to where it is today. The US diamond industry has been built on high product standards, high quality and above all, high ethical business practices that are maintained by its member companies, even to the point of having the Code of Ethics written in the front of each year’s Membership Directory for all to see. US diamond products set the standard for the world and are sought after in the most demanding applications. The US diamond industry continues to advance the use of Superabrasives through R&D, innovation and application. The global diamond market has changed over the years and DeBeers (now Element 6) along with FEPA have helped lead the European industry and the IDA of Japan has advanced the Japanese industry, all the while working towards the same high ethical and product standards. In recent years the diamond industry has rapidly evolved in China and China is now the largest producer of superabrasives in the world. Our two cultures may differ in many ways, but to succeed and do business together we must all adhere to the same high product and ethical business practices that have been established by the pioneers in the industry. America and China must work together… one, the largest consumer of superabrasive materials, the other as the largest manufacturer of superabrasives.”

Our IDA Board of Directors and the Executive Management encourage all eligible companies to join with the current membership of the IDA and share their thoughts on our industry in open discussions at the IDA Annual Meeting May 21 - 23 in Scottsdale Arizona. For more details visit the IDA website at www.superabrasives.org

Sincerely,

Chris Winkel, President
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THE INDUSTRIAL DIAMOND ASSOCIATION 2012 –
A STRATEGIC PLAN

The IDA of America has a long and distinguished history since its inception in 1946 and is the oldest and one of the most well respected associations in the superabrasives/ultra-hard materials industry. The industry has progressed through innovation and development since the early days and has evolved into a much more complex industry with the introduction of new materials in the form of synthetic superabrasives (Diamond and CBN), polycrystalline products (PCD & PCBN Tools) and other processes such as CVD (Chemical Vapor Deposition) and growth of large single crystal diamonds.

Just as the industry has evolved and reinvented itself, the IDA of America as the premier association representing the industry, must continually improve and stay relevant in order to service and be of value to its membership. To achieve this goal the IDA Board of Directors has recently established a Strategic Planning Committee to develop a “Strategic Plan”. The plan will allow the Board of Directors to develop and focus on initiatives designed to meet the mission of the IDA while keeping the Association in tune with the changes in the industry.

The Strategic Planning Committee was established in May 2011 by the IDA Board of Directors and has developed a plan that was adopted by the Board at the September meeting in Columbus OH. The plan focuses on the mission of the IDA:

- To promote the use, application and development of superabrasive/ultra-hard materials industry of North America.
- To serve as the primary voice of the superabrasive/ultra-hard materials industry in North America.
- To develop and facilitate technical and educational programs focused on applications and uses for superabrasive/ultra-hard materials.
- To create, collect and/or disseminate superabrasive/ultra-hard materials standards and regulatory information.
- Establish the venue for member interaction and the exchange of ideas on a global basis.

In order to achieve the mission statement goals of the IDA, the Association’s structure will be reorganized to have six standing committees. They will be as follows:

**The Strategic Planning Committee:** To review, on an annual basis, the activities of the IDA and to recommend changes to the Strategic Plan that will promote continual improvement of the Association.

**The Promotional Committee:** The Promotional Committee, through sub-committees, will be responsible for promoting the IDA to the outside world (end users, academia, etc.) and to the membership.

**The Education Committee:** The Educational Committee will develop educational programs to further the understanding and application of superabrasive/ultra-hard materials.

**The Technical Advisory Committee:** Will be responsible for reviewing technical papers for presentation at INTERTECH and technical content of articles published by the IDA.

**The Standards & Regulatory Committee:** Will work with Standards Organizations and Government Regulatory Commissions in developing and reviewing standards and regulations applicable to the industry.

**The Finance Committee:** Will work with the Executive Director in preparing and developing budgets to fund the activities of the IDA.

The IDA Board of Directors will review and critique the activities of the Committees. Goals and timelines will be set to ensure progress towards the initiatives being taken. Some of the topics being discussed are:

- Focusing on growing the industry through end-user education and awareness.
- Reorganizing INTERTECH to attract potential end-users while maintaining the New Development and Education sessions.
- Redesigning the IDA website and considering entering into some of the communications media such as Facebook and Twitter.
- Cooperating with other trade organizations in lobbying and other areas of interest.

The IDA recognizes that it must bring value to its membership in order to remain effective; however, it needs you, the members of the IDA of America, to get involved and to make a difference through participation. We encourage you to consider involvement in one of the Committees and contribute to the Association for the good of the industry and the membership. The IDA Board of Directors wants to hear from you how we can make the IDA work for you, its members.
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In Memoriam

The Industrial Diamond Association of America recently lost two more of its longtime members that helped make our Association such a strong and vibrant organization. They will be missed but never forgotten by those of us who held them in such high regard.

Thomas M. Bluemle 43
September 18, 1968 • December 26, 2011

Tom was a friend and colleague to anyone he met. An honest and hard working entrepreneur, Tom carried the excitement that inspired you to be a part of whatever it was he was working on. Through his actions and deeds, Tom exemplified a dedicated family man, motivated leader and a truly loyal friend. Tom graduated with a Bachelors degree from John Carroll University, after which he started his career in the diamond industry. Following in the footsteps of his father, Albert, he became the President of Niabraze in 2000, and continued to be a driving force in the research and development of the company. Tom has been an IDA member since 1999.

Thomas Corcoran 56
February 21, 1955 • December 23, 2011

Tom was the president of American Superabrasives, Anco Industrial Diamonds, and Trigon Technologies. Tom joined Anco Industrial and learned sorting, then started on buying trips to Antwerp, Belgium. Though Tom worked with natural diamonds, in 1979 DeBeers Industrial Division started making Polycrystalline Diamond (PCD) and Polycrystalline cubic boron nitride (PCBN) and Tom was asked to learn more about these new materials. Tom was one of the key people in developing the business of PCD PCBN and synthetic grits during his travels, but he also sold the natural dresser stones as well. His friendly easygoing approach opened many new markets in foreign countries. In 1983 Tom and Chris Danielak were running Anco day to day so in 1986 they purchased the Anco Industrial natural diamond business. Chris and Tom started American Superabrasives Corporation in 1988 and started selling powders and other synthetics. They started working with another PCD/PCBN maker in South Korea started their own operation in early 2000. Through all this Tom was a devoted husband and father, never missing a minute when his family needed him. Tom was always caring for the underdog, the homeless, the poor, he was very active in his local church and worked with a local charity delivering donated foods to soup kitchens and little "outreach" convents all over New York City. Tom was the key man supporting fair trade and showing concern for the average toolmaker, even to the point of legal action in support of their rights.
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2012 Annual Meeting
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Scio Diamond manufactures laboratory-created or "cultured" diamonds in the USA. Formed in April of 2011 by acquiring the majority of assets from the Apollo Diamond Company in addition to the protected technology, Scio Diamond is locating its production facilities in Greenville, SC and its R&D headquarters in Hudson, MA. It is Scio's firm belief that the Scio Diamond will become an important component of the diamond jewelry market as well as the operating system platform of choice for future technology applications and as an industrial material will become the wear resistant materials of choice.

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Initially Scio will enter the diamond gemstone industry at time when demand for mined diamonds is being outstripped by demand and large, high quality gemstones are becoming increasingly rare. The Scio Diamond Technology has demonstrated production of single crystal diamond gemstones of colorless and fancy colored varieties in finished stones generally ranging in sizes from .25 carats to over 2 carats. As production begins in the second quarter of 2012, the majority of Scio's R&D focus will be to advance its production technology into new generations of mass production of all types of diamond. This will be accomplished by moving from the current 3” growth technology to the 4” and 6” growth technologies, which has already been proven in test runs. Additionally through its patented mosaic integration Scio will create extremely large pieces of diamond allowing greater production of high quality diamond for all markets.
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The tooling community is well aware of the present challenges and opportunities in machining aerospace components, although not necessarily familiar with all the solutions available, the latest guidelines on the selection of the optimal materials and the most recent developments in the industry. The three categories of work material which are most topical today are carbon fibre reinforced composites (CFRP), nickel alloys and titanium alloys, each being unique in terms of the demands they place on cutting tools.

CFRP is highly anisotropic and the main quality criteria - delamination of plies, protrusion of uncut fibres and deviation in the diameter of drilled holes – are highly sensitive to the rounding of cutting edges which occurs rapidly for most tooling materials. While uncoated carbide tools are employed to some extent, PCD and diamond-coated carbide are the preferred choice for drilling and routing operations. The latter class of tooling continues to suffer from the risk of delamination and is limited with regard to edge sharpness – typically tens of microns, compared to microns from PCD. With increasingly flexible and economical PCD tooling material formats being developed and commercialised, PCD is likely be the only viable solution for the majority of industrial applications.

Routing is the other critical operation in the manufacture of CFRP components. Here, high-quality PCD grades exhibit approximately one tenth the wear rates as diamond coated carbide tools. In a series of routing tests on one of the more abrasive types of CFRP (HTS fibres in Cycom resin) with different PCD grades, employing various new PCD technologies including Multimodal PCD, Ultra-fine was found to be only 2.5 µm per linear meter machined for all grades, compared to 20 mm/m for diamond coated carbide – Figure 2. It was also necessary to run the diamond coated carbide at a 30% lower cutting speed so as to avoid immediate catastrophic tool failure. The optimal grade of PCD for routing will very much depend on the specifics of the operation, but tool designers must also appreciate the flexibility provided by certain grades of PCD. For example, Ultra-fine grain PCD – being a one-micron grade with relatively low cobalt content, provides for reduced grinding and
erosion times and critically, much greater freedom in terms of tool design. With a transverse rupture strength (TRS) of approximately 2 GPa, Ultra-fine grain PCD can tolerate much larger clearance or rake face angles when compared to all other grades, resulting in lower cutting forces and temperatures and therefore, less fibre pull-out and delamination.

The use of PCD for turning and milling titanium alloys is becoming increasingly attractive relative to coated and uncoated carbides. Despite the price differential, the ability to run PCD at 4 – 5 times higher cutting speeds with similar or greater tool lives (measured in minutes), has a huge impact on production capacity and ultimately, lowers overall production costs. PCD is not only suitable for fine finishing, but can also tolerate very heavy cuts through the use of specific cutting edge microgeometries. Contrary to the fact that coarse-grain PCD grades are more thermally stable and therefore, intuitively may seem better suited for titanium machining, Ultra-fine grain PCD has been found to be the optimal grade in terms of wear resistance – by a factor of two over most coarse-grain materials. When correctly applied, PCD is capable of providing tool lives of 30 minutes in continuous cutting operations with cutting speeds of 200 m/min before reaching end of life (0.3 mm flank wear). Furthermore, flank wear is the primary wear mode such that a stable, well-defined cutting edge is maintained throughout tool life – PCD does not suffer the usual attrition wear on the tool rake due to welding of the titanium chip. While the underlying tool wear mechanisms are not fully understood, Ultra-fine grain PCD has been found to be optimal tooling material for both wet and dry turning and milling. The use of high-pressure coolant systems offers further potential to improve the performance relative to conventional tool materials.

Virtually all PCBN grades are marketed for hard (or powder-metallurgy) steels and cast iron machining applications. Nonetheless, a significant volume of PCBN is used in commercial production of superalloy aero engine and power generation components – largely for semi-finishing and finishing operations. The range of alloys in use and the number of metallurgical conditions in which the materials are machined, has made grade selection more complex than for other applications. Depending on application specifics, low or high CBN grades may be optimal. Interrupted cutting applications are primarily the domain of fine-grain high CBN materials such in the 85% to 90%CBN content range – most likely due to their greater thermal shock resistance. While these grades are also successful in certain continuous turning operations, materials with lower CBN-contents are often found more appropriate. One of the parameters which seems to influence – at least in part – whether low- or high-CBN grades are more appropriate, is the maximum un-deformed chip thickness, $h_{max}$. Figure 3 shows the

![FIGURE 2: Wear rate of PCD and diamond-coated carbide tools in routing CFRP with diameter 10 mm two-flute straight-edge tools.](image)
results of continuous turning tests undertaken on Inconel 718 of 40 HRC with PCBN and conventional tool materials where only the cutting speed and tool nose radius was varied.

The key point is that where the combination of feed, depth of cut and nose radius results in a thin undeformed chip, high CBN grades out-perform low-CBN grades and vice versa. Note, also the relative performance of PCBN over ceramic tools when operating at 300 m/min - although moderate when compared to for example, grey cast iron machining, such a multiple provides the ability to dramatically reduce downtime on machine tools – a key consideration when tool lives are only of the order of minutes. Note also the potential productivity gains over carbide tools – namely a four-fold or more increase in tool life.

In conclusion, superhard tooling materials have been used for many years in the aerospace industry albeit often on a niche basis. However, the evolution of work materials and indeed, advances in PCD and PCBN materials and formats, point to a future where many, if not the majority of aerospace manufacturing operations will be done with superhard tools. In terms of both productivity and part quality, the price: performance ratio for superhards over conventional tooling materials is being confirmed favourable in a rapidly increasing number of applications.

ACKNOWLEDGEMENTS: The authors are grateful to STF Precision in Arden, USA for the manufacture of PCD routers used in recent studies as well as to Prof. Wolfgang Hintze and Tobias Geis in the Technical University of Hamburg Harburg for undertaking routing tests.
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Website: www.kydiamond.ca

Lach Diamond, Inc.
Website: www.lachdiamond.com

Lieber & Solow Co.
Lands Superabrasives Co.
Website: www.lieberandsolow.com
Website: www.landssuperabrasives.com

Lunzer Inc.
Website: www.lunzer.com

Megadiamond Inc.
Website: www.megadiamond.com

Michael Werdiger, Inc.
Website: www.michaelwerdiger.com

Microdiamant AG / Mypodiamond Inc.
Website: www.microdiamant.com
Website: www.mypodiamond.com

Morgan Advanced Materials & Technology
Website: www.morganplc.com

National Research Co.
Website: www.nationalresearchcompany.com

Niabraze Corp.
Website: www.niabraze.com

Noritake Co Inc.
Website: www.noritake.com

North Jersey Diamond Wheel
Website: www.diamondwheels.com

Pinnacle Abrasives
Website: www.pinnaclesf.com

Precision Eforming
Website: www.precisioneforming.com

Protech Diamond Tool Inc.
Website: www.protechdiamondtoolsin.com

Radiac Abrasives Inc., A Tyrolit Company
Website: www.radiac.com

Scio Diamond Technology
Website: www.sciodiamond.com

Sp3 Cutting Tools Inc.
Website: www.sp3cuttingtools.com

Sp3 Diamond Technologies
Website: www.sp3diamondtech.com

Spec Tool
Website: www.spec-tool.com

Standard Die & Fabricating Inc.
Website: www.standarddie.com

Sumitomo Electric Carbide Inc.
Materials Grp.
Website: www.sumicarbide.com/diamondgroup

Superabrasives Inc.
Website: www.superabrasives.com

Syntech Abrasives Inc.
Website: www.syntechabrasives.com

Tomei Corp. of America
Website: www.tomeidiiamond.com

University of Louisville
Website: www.cvd.louisville.edu

US Synthetic Corp.
Website: www.ussynthetic.com

Vollmer of America Corporation
Website: www.vollmer-us.com

Wemex Superabrasivos, S. DE R.L. DE C.V.
Website: www.wemex.com.mx

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Website: www.winterthurtechnology.com

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Review of the Mesh Superabrasive Industry 2011

DIAMOND INNOVATIONS INC. 
Worthington, Ohio
CHIP RAREY, Director
Mesh/Micron Products

2011 was a year that started off in a similar way that 2010 finished, with the continuation of the recovery from the global financial crisis. However, as the year progressed, increased volatility and market uncertainty became the underlying theme, leaving the markets wondering what is in store in 2012 for diamond and cubic boron nitride (CBN) demand:

The automotive markets rebounded, particularly in North America where production levels rose by 9-10% vs. prior year levels. Government incentives ended in China which succeeded in pulling forward demand into 2010, so production and sales growth slowed to tamer levels of 3-5%. The earthquake and tsunami in Japan caused significant supply chain problems for automotive production, as part shortages were experienced for extended periods of time causing production stoppages. Japanese auto production was down 18.5% from April to Sept timeframe as a result. CBN demand for use in automotive applications was adversely affected as a result. Vitrified bond systems as well as an increase in hybrid bond systems continue to be the largest portion of the market. Electroplated wheels follow with the emphasis on tightsized control of sizes to improve over-all wheel performance.

Conversion of some conventional wheel applications to CBN has been made possible with higher performance products used in aerospace applications. New CBN products have been developed which provide increased wheel life and lower power, reducing the risk of work-piece burn in sensitive superalloy grinding applications of engine components. The housing woes in the US continued to weigh on the overall construction market, but highway project work improved somewhat for the year. Mineral and precious metal exploration continued to expand as rising commodity prices drove the market for increased activity. Use of high grade diamond as well as coated products slightly improved as a result.

The electronics market saw significant growth in the first half of this year, driving increased demand for micron diamond powders. In the dynamic LED lighting segment, the recent added capacity and new market entries (particularly in China) caused over-production and falling-pricing. However, the overexuberance of the market followed by the floods in Thailand, caused production slowdowns in the latter half of the year, even though the long-term market outlook for demand remains positive. Focus on diamond particle size distribution and product consistency remains critical to success in this industry. In the tool and cutter market which largely uses resin bond diamond wheels, an increased focus on improving work-piece quality and increasing throughput caused an increased emphasis on selecting the right diamond abrasive for the job. Premium coated diamonds with longer wheel life, lower grinding energy, and improved crystal retention experienced volume growth. This trend of focusing on total system performance over lowest initial wheel price is expected to increase in the coming year, particularly as the cost to produce carbide continues to rise.
I last wrote on the diamond wire die “state of the economy” in 2003. In 2003, the diamond wire die business was experiencing a severe downward spiral that began at the turn of the new millennium. Most of the diamond wire die fabricators (which is directly related to the wire and cable industry) would confirm this trend has continued, or at best, hit bottom and leveled off, depending on whom you ask.

There are several reasons for the leveling off/dropping trend of wire drawing in North America. First, a significant percent of wire drawing has moved off shore in response to the off shoring of original equipment manufacturers that use wire. This trend happened quickly and left little resources for a rebound. Secondly, many of the remaining wire drawers have merged. The biggest obstacle, perhaps, encouraging this trend in the last decade is that the non-copper commodity/high volume product has moved to and stayed overseas without notice and has had no encouragement to return from the North American governments. For example, countries such as Korea who produce stainless steel products continue to give government subsidies to Korean wire producers for their exports, especially to the US. This has been a decade of the “perfect storm” for diamond wire die producers and wire drawers. I stated in 2003 that some of the loss was related to 911, loss of confidence in large corporations (accounting scandals), and poor performance of the stock market. Since then, the US has been involved in world conflicts, large housing inventories, lack of confidence on Wall Street, a recession with the threat of a double dip recession, lack of borrowed monies and recently extreme regulations. Adding to the downward trend little has been done by law makers in the past three years to combat this trend and encourage growth of the diamond wire die/wire industry in the U.S.

As a result, the wire industry in North America has had to evolve wherein wire mills keep smaller tooling inventories and require smaller lot sizes, shorter lead times and customized specifications for their wire dies. Consequently, local service had become much more important in the last decade.

New wire applications and the industrialization of emerging markets continue to drive global growth of the wire industry. Emerging markets such as saw wire for solar panels, medical wire such as nitinol and super conductor wire for MRI machines are some examples. Globally, effects of surging commodity prices have put pressure on the margins of not only wire die manufactures, but superabrasives manufacturers of all types. Soaring diamond prices, rare earths pricing increases (60%+), and considering 88% of the world synthetic diamond supply coming out of China will hopefully gain the attention of the US government, whom should consider this a national security threat.
I frequent two local hardware stores. One hardware store is not so much a “hardware” store as it is a modern day “mega-ware” store. The shelves and items are categorized and properly labeled and aisle 12 definitely has those plumbing fixtures as marked! Here, the help may be a college student or a retiree looking to subsidize his social security pay. The feel here is truly modern, up-to-date and most of all BIG! Nothing in this store says comfortable, but it sure shouts “high-tech”. In this store you can find every possible tool, lumber, a nursery, electrical devices, carpeting & drapes, riding lawnmowers and other gas powered behemoths that can perform every man-sized operation from edging your yard to taking down the huge oak tree out back and then grinding the huge stump into a mound of sawdust! This place is the do-it-yourself Utopia! You can download plans and instructions for every project and even get that diamond sawblade to cut those patio blocks and concrete slabs to perfect shape and size. I marvel at the way these diamond sawblades have become such an everyday tool for so many uses! Diamond blades can be rented with a state-of-the-art stone cutting machine or you can buy the blades to perform any home project! Even the restrooms in these mega-ware stores take technology to a new level with a magic light that turns on when you enter and soap containers that “sense” when you are there and deliver measured quantities with motion-detecting faucets and automatic hand towel dispensers.

My second hardware store is right out of a Norman Rockwell painting, with creaking wooden floors and the inviting aromas of oil, paint and a combination of leather, cloth and metal that gives the customer a longing to “hang out” and just peruse the aisles. This is the store where I know that I can find that part to an old power tool or machine not being made anymore … you know the one, your dad gave it to you many years ago and you keep it repaired and usable because it has history. I can also find that strange plumbing fixture or random handle off an old dresser. I love the place, because you’re not going to go to “aisle 12” that is properly labeled for “plumbing fixtures”, you’re going to ask the proprietor for what you need and show him the broken piece or describe what it came from and he will look over his pair of wire rim glasses and snap to his suspenders and then start pulling things from the front of shelves until he manages to find the item you so desperately need stashed away far in the back… where it has been since 1960, the time he last saw it! If you have a “do it yourself” job, the proprietor would be delighted to explain in great detail the exact procedures and materials needed to do the job right ... he may even volunteer to show up at your house to supervise if you really look lost! If I asked him for a diamond sawblade he most probably would give me a look like I’d lost my mind.

The other day I walked into their restroom to wash my hands and stood there for a few minutes waving my hands under the soap dispenser. To my dismay I actually had to manually push the pump and then physically turn the water on and pull down a paper towel … I guess “do it yourself” does have a whole new meaning…
Meeting the challenges of the diamond markets and meeting the demands of industry, natural industrial diamond tooling and processes continue to enhance processes and products through all of the applications where natural diamond, nature’s best product, is the only choice.

The demand for natural industrial diamond, after the crisis of 2008/2009, remains strong and continuous. This proves the resilience and advantage of natural diamonds in industry. While there are no real numbers available, as a world leader in the supply of natural diamonds, our order books have been full throughout 2011 and our customers are anticipating increasing demands into 2012.

Endusers continue to find that alternative products and processes cannot replace most of the tried and true natural diamond tool products and processes. Natural diamond provides the most effective and consistent properties for so many different industrial processes ... they continue to be the material of choice for a broad range of applications, including but not limited to:

- Truing and Dressing of Grinding Wheels
- Production of Fine Wire
- Water Jet Nozzles for Material Cutting
- Direct Precision Cutting and Material Processing
- Material Testing
- Drilling, Grinding, Polishing and Finishing Applications

These products and processes remain at the heart of industry, technology, medical and dental processes and products as well as science and research. While the worlds diamond markets have gone through changes which have created some supply challenges, regular supplies of natural diamonds are available for traditional and modern tooling and processes.

**CHANGES AND CHALLENGES IN THE ROUGH DIAMOND MARKETS:**

- Pricing of natural diamond has been driven up by strong demand at tenders and auctions held in all of the global diamond centers. This has affected industrial diamond as well as gem diamond pricing.
- Pricing increases are a reflection of strong demand for a full range of rough diamonds for gem and industrial markets.

**EFFECTS AND SOLUTIONS:**

- Strong competition for “near gem” materials from other markets is countered by the ability of natural industrial diamond suppliers to source wide ranges of materials, ensuring supplies to all diamond tool manufacturers.
- With prices rising, informing tool makers of the actual price situation has enabled them to adjust pricing and work these prices into the manufacturing process.
- Ensuring the availability of materials has become the critical role of suppliers. By establishing new and correct price levels for industry, suppliers are able to meet and ensure continuity of supply.
Since its introduction in the mid-1980’s, chemical vapor deposition (CVD) diamond has seen strong growth, and is currently experiencing rapid adoption across multiple industries as an enhanced material of choice due to its exceptional strength, durability, stiffness, high thermal conductivity and its electrical isolation properties. According to BCC Research, the global market value of diamond, diamond-like, CBN films and coating products was an estimated $904.5 million in 2010, but is expected to increase to more than $1.7 billion in 2015, for a 5-year compound annual growth rate (CAGR) of 14.1%. Early applications for CVD diamond focused largely around thin- and thick-film (freestanding) polycrystalline diamond for cutting tools and dressing applications. When it comes to cutting tools, achieving strength through proper film thickness and durability from proper film adhesion is the key to the longest wear and best cutting performance. Newer applications that take advantage of CVD diamond’s mechanical properties include wear parts, such as watch gears, and CMP pad conditioners. Emerging microelectronic components -- such as high-speed processors, medical devices, wide bandgap radio frequency (RF) and power conversion devices, and opto-electronic devices (LEDs, Laser Diodes, VCSEL arrays) -- generate exceptionally high heat densities that require innovative approaches to thermal management. Freestanding diamond has tremendous potential for electronics applications because it significantly improves upon current strategies for thermal management while remaining highly cost-competitive with more esoteric approaches. In semiconductor manufacturing, wafer scale diamond offers enhanced mechanical material properties such as significantly higher stiffness, strength, hardness, thermal conductivity, and chemical robustness, over silicon and most other thin-film materials commonly used in microfabrication technologies. Diamond coatings are finding increasing use in electronic applications because of the high thermal conductivity of diamond (10x that of silicon). Micro-electro-mechanical systems (MEMS), such as RF MEMS resonators, have design needs that offer a compelling case for the adoption of diamond as a base material due to its high Young’s Modulus as well as its durability in harsh environments. Boron-doped diamond (BDD) electrodes for water treatment are experiencing significant exploration due to diamond’s potential as an environmentally friendly, high performance electrode material. BDD electrodes have many characteristics that make them ideal for eliminating organics from water, including a large potential window, lower absorption, corrosion stability in very aggressive media, high efficiency in oxidation processes, very low double-layer capacitance, and background current. Historically diamond has been perceived as an expensive material. Advances in CVD diamond manufacturing and the development of higher-throughput hot filament (HF) CVD diamond reactors have contributed significantly to reducing material costs and cost of ownership. This has led a broad array of industries to revisit development activities and actively pursue the use of CVD diamond for an everincreasing number of applications.
VOLLMER OF AMERICA IS PLEASED TO ANNOUNCE THE INSTALLATION OF THE FIRST QXD200 MACHINE IN CANADA WITH ROYCE//AYR CUTTING TOOLS

Cambridge, Ontario – This machine provides state of the art finishing for PCD tools, combining rotary erosion and grinding for complete processing of helical tools in a single machine setup. Six programmable axes allow for continued innovation in tool design, while the six position tool changer allows for flexibility in electrodes and polishing wheel selections that can be utilized in unattended operation. Vollmer continues to incorporate simplified programming for ease of training, and its modular design allows for several automation options to be incorporated as tool demand dictates.

ELEMENT SIX VENTURES OPENS REPRESENTATIVE OFFICE IN SILICON VALLEY ... A World Leading Synthetic Diamond Innovator and Producer establishes Venture Group Capital Fund to Expand Portfolio

Sana Clara, CA – Element Six, a global leader in the design, development and production of synthetic diamond super materials, is pleased to announce the recent opening of its new Ventures representative office in Silicon Valley. Located in Santa Clara at a planned Element Six production site, the company will focus on broadening its portfolio of early-stage emerging-technology investments in the region. “Synthetic diamond’s extreme properties enhance performance in new technology applications to levels not otherwise possible,” said Susie Wheeler, Managing Director, Element Six Ventures Group. “Locating the Ventures’ office in Silicon Valley allows us to connect with new partners who, like us, want to develop these emerging technology investments.” An active investor worldwide since 2006, Element Six Ventures specializes in seed to late-stage technology ventures which utilize synthetic diamond and other super materials demonstrating scalable and commercial potential. To date, the firm has invested in seven portfolio companies operating within the clean-tech, semiconductor and electronics sectors. For more information visit: www.e6ventures.com

H3D TOOL CORP. FURTHER EXPANDS CAPACITIES TO SERVE THE INCREASED MARKET SHARE OF INTERNATIONAL BUSINESS

Newcomerstown, OH – H3D Tool Corp. continues to respond to increased demand for their custom cutting tools with a factory expansion that includes delivery of a wide range of additional equipment including a Vollmer QWD 760H machine. The QWD760H machine is a 5 axis horizontal wire erosion machine that has become the industry standard for processing tight tolerance PCD tools. The 760 has the added ability to produce tools between centers ensuring that the most reliable performance can be attained when running at higher spindle speeds used in many milling applications. H3D Tool Corp. offers a wide range of tooling for various industries and market segments. Visit: www.h3dtool.com for additional information.

MANUFACTURING REBOUND WILL CONTINUE INTO 2012

Arlington, VA – U.S. manufacturing industrial production rebounded in the third quarter of 2011, growing by 4 percent, and is extending into the final months of the year, according to the Manufacturers Alliance for Productivity and Innovation (MAPI) U.S. Industrial Outlook (ER-734), a quarterly report that analyzes 27 major industries. “The growth is being led by the energy, transportation, and incomplete process industries,” said Daniel J. Meckstroth, Ph.D., MAPI Chief Economist and author of the analysis. “We believe the continuing pickup in domestic auto production will also be a major driver of overall economic growth next year. “We project that the pace of manufacturing growth will outperform overall GDP growth. Pent-up demand for postponed consumer durable goods continues to exist, particularly in motor vehicles,” he added. “In addition, firms are profitable and have the need to spend more for both traditional and high-tech business equipment, and reasonably strong growth in emerging economies is still driving U.S. exports.” The report offers economic forecasts for 24 of the 27 industries. MAPI anticipates that 18 of the 24 industries will show gains in 2011. For further information visit: www.mapi.net
The outlook of the superabrasive powder industry for the near term continues to be bright. While the general domestic economy is mired in relatively slow growth, a number of factors continue to drive the micron and nano-diamond business forward. First and foremost is a drive for better quality components, and hence improved finishes and tighter tolerances.

The demand for micron size powder based products is growing for electronics applications, fixed abrasive finishing technology and polycrystalline diamond synthesis. Solar panel production is another growth area, as diamond wire saws are a critical process in their production.

Fixed abrasive films have also grown in prominence, utilizing micron sized diamond in the optical and photonics field. Diamond films are required in the roughing of sapphire based components as they are too hard for traditional abrasives such as cerium oxide.

China has emerged as the dominate player in the production of diamond powders. Their technical capabilities continue to improve and production capacity is increasing exponentially. This has been coupled with the fact that China is also becoming a major player in the production of LEDs, whose Sapphire, GaN or SiC based substrates currently require processing with nanodiamond based consumables. In addition, China is emerging as a leading producer of the aforementioned solar panels so will be a significant market for micron and nano diamond powders.

Unless the manufacturing sector begins to suffer from the general malaise in housing, construction etc., the emergence of exciting new materials and applications should be a strong driver for continued growth of micron sized diamond powders in 2011-12.
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2012/2013 EDITORIAL CALENDAR

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<td>Spring 2012 Grinding &amp; Machining Advancements</td>
<td>Feb. 15, 2012</td>
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<tr>
<td>Summer 2012 CVD Diamond &amp; cBN</td>
<td>May 15, 2012</td>
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<tr>
<td>Fall 2011 IMTS Issue (Machines and New Technology)</td>
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2011 began with headlines proclaiming a rapid increase in manufacturing and predictions of a complete return to the rates seen prior to 2009. Machine tool builders welcomed this news as typically demand for their products follows production needs for increased capacity, as illustrated in the chart below. The headlines throughout the remainder of 2011 were not unified in this message as many predicted stronger growth while others continued to believe in a continued downturn. Many industry experts even predicted a double dip in the economy.

This uncertainty was also reflected in the buying habits and demands for machinery, particularly machines used in the manufacturing processes associated with production of tools containing superabrasive materials. Tool makers, and grinding wheel manufacturers seeing an increase demand for their products were reluctant to hire additional workers, and those that did decide to hire, had difficulty finding qualified people.

Requests for additional capacity as experienced in previous years were replaced with increased interest in new technology, automation, and machines that performed multiple functions. Businesses looked to invest in new technology in anticipation of growth into similar markets. This was very apparent as traditional suppliers for the automotive industry began supplying tools for aerospace customers. Companies that traditionally concentrated their energy in various wood applications such as laminates and MDF began supplying tools for machining of many rubber and plastic components as well as simple aerospace tools. Automatic machine operation was seen as a method in many cases to overcome the inability to find qualified workers, and also as a solution to lower overall production costs. Businesses that were willing to invest in new machines also demanded that the machines combine functions previously completed on multiple machines.
The machine tool manufacturers were quick to adapt to these requests with software and hardware modifications on existing machine platforms. Automation on many machine tools became modular so that it could be added and changed as production demand dictates. Flexibility was incorporated into machine tools as erosion machines gained the ability to perform some grinding operations, and some grinders were adapted to include erosion generators. Many of the traditional grinder manufacturers also adapted their spindles to hold work pieces so that simple turning operations could be performed. Laser technology continues to be explored and refined as well.

These changes in both machine manufacturing and consumer demand have helped lead to sustained growth of machine tools sales. The graph below from EDA IndustryInsight shows that machine sales are clearly recovering as they approach the levels seen prior to 2009.

In addition, machine tool sales are somewhat cyclical as capacity and technology needs are met. This graph, also courtesy of EDA IndustryInsight, shows the normal cyclical demand for machine tools in references to the ten year average.

As industries continue to use superabrasive materials to optimize processes and lower manufacturing costs, machine tool innovations will continue to be developed. 2012 is expected to be an especially important year in this continued recovery. Machine tool builders are anxious to show new technology, increased capabilities, and improved automation features at the Grindtec show in Germany beginning in March, the IWF show in Atlanta in August, followed by IMTS this September in Chicago.
NEW HIGH-PERFORMANCE COOLANTS SPECIALLY FORMULATED FOR MACHINING TITANIUM, SUPERALLOYS AND HARDENED STEELS

January 2012 — MAG’s new CYCLO COOL® 900 and 5000 series synthetic coolants are additive free, low foaming and specially formulated for machining titanium, Inconel, beryllium copper, hardened steels, stainless steels and other superalloys. Developed for the aerospace industry, the new coolants are an ideal replacement for semi-synthetics and soluble oils, delivering significant cost savings with lower initial cost, longer tool life, increased stock removal rates, reduced housekeeping, long sump life, and freedom from biocides/fungicides/pH adjusters. These new coolants use unique synthetic formulations to provide boundary lubricant properties, while penetrating the heat barrier in the cutting zone, even at lower pressures (300 to 400 psi), to absorb heat from the tool and part, and minimize chemical reactions between tools and workpieces. For more information visit: www.mag-ias.com

SPARTANICS UNVEILS L-350 HIGH SPEED LASER CUTTING MACHINE UNSURPASSED CUT QUALITY FOR ABRASIVES

Spartanics L-350 High Speed Laser Cutting Machine’s single laser head design enables highest quality cuts with a 210 micron spot size in a 350 mm cutting field at speeds as fast as 80 meters/minute. The L-350 automates optimization of web speed, eliminates quality issues in many applications that require stitching cuts from two laser sources enables job changeovers on-the-fly and is widely recognized as the most operator-friendly technology due to its intuitive operator interface and “behind-the-scenes” sophisticated control engineering software. Spartanics L-350 High Speed Laser Cutting Machine includes UV coating stations, lamination, slitting and sheeting options. Superior cut quality is achieved with polyester, polycarbonate, polypropylene, metalized and paper among a wide range of other materials. For more information visit: www.spartanics.com

ROLLOMATIC INTRODUCES A 5-AXIS LASER ABLATION MACHINE FOR 3-DIMENSIONAL MACHINING

Mundelein, IL – Rollomatic, a leading machine tool manufacturer based in Le Landeron, Switzerland, continues the success and growth of its series of CNC multi-axis tool grinding machines by announcing the addition of a laser ablation machine LaserSmart. The initial strategy with this machine is to offer extra-fine 3-dimensional laser machining for the cutting tool industry. This machine is particularly suited for super-hard materials such as PCD, cBN and other high-technology materials. The surfaces on which laser machining is performed does not have to flat, it can have an arbitrary geometry. Preliminary applications are rake faces, chip breakers, logos and tool numbers on PCD, cBN or CVD silicon carbide inserts. For further information visit: www.rollomaticusa.com

MINI TOOLHOLDER CLAMPS 0.3MM TOOLS

The TRIBOS-Mini directly clamps the smallest of tool shanks consistently along the entire axis. Machining medical, dental and micro level parts are the most challenging applications faced today. This innovative toolholder from SCHUNK eliminates troublesome collets, collet nuts and inconsistent tool clamping. With run-out accuracy of less than 3 microns and a balance grade of G2.5 at 25,000 RPM, high RPMs and fast federates are achievable. Unique in the proven TRIBOS design is the direct clamping through the elasticity of the tool holder material. The patented TRIBOS technology utilizes a polygon form in the clamping bore to generate the clamping. Cutting tool clamping results are simplified without influence of operator. The holder is inserted into the TRIBOS press and cutting tool is released in less than 30 seconds. TRIBOS-Mini offers all of the benefits of the TRIBOS family, with an extensive line of holders and extensions. For more information, visit www.schunk.com
SUPERABRASIVE EDUCATION PROGRAM

Industrial Diamond Association of America – Superabrasive Materials, Products and Applications Regional Industry-Focus

DAVID EDWARDS, Director of Sales & Marketing
Action Superabrasive Products, Inc.

Where can end users get "state-of-the-art" or perhaps more importantly, "state-of-the-science" information regarding superabrasive products and their applications? Where can end users go to get unbiased information and the basic fundamentals for the use of superabrasives from leading experts in the industry at a very reasonable cost? The answer, the IDA! If the launch of the IDA’s Educational Course that was held concurrent to INTERTECH 2011 in Chicago is any indication, we shouldn’t have too much trouble filling the room in future programs. We are preparing to take this program forward as a stand-alone Educational course. This is an IDA program sponsored wholly by the IDA and its membership, designed specifically to promote the use of superabrasives. The program is designed to be unbiased and representative of accepted principles and practices in the industry. The program will cover a wide range of products and applications of superabrasives for a variety of industries. The three major areas of concentration will include grinding, machining and uses as a wear resistant material.

Slightly different than the course introduced in Chicago which covered a wide variety of applications and industries, future programs will be regional industry-focused educational programs. We will target specific industries such as automotive or aerospace industries. The location/venue of each course will also be strategically based making it easy (convenient and economical) for end users within that industry to attend. Each program will be designed to train anyone associated with production processes/applications or design responsibilities (managing, directing, buying, employing) for tools or abrasives. Engineers, machine operators, production supervisors, lead process people, decision makers etc. Our objective will be to educate, inform and promote superabrasives. We will define Superabrasives (What they are & where to use?) discuss types of products and applications for grinding, machining, and hard coatings. The benefits for use will also be covered in detail. The goals for this educational program are very simple: 1. Educate end users that employ superabrasives now, to know more about how they can optimize their use and perhaps expand into other areas. 2. Educate end users that may be unfamiliar to superabrasives to consider their use. 3. Educate end users on the benefits of superabrasives as compared to conventional technologies.

Our first regional industry-focused program date and location will be announced soon. We encourage all members to be involved in this endeavor and welcome your participation. Any member interested in being on the education committee that is currently working on these programs, please contact David Edwards- Education Committee Chairman or Terry Kane- Executive Director of the IDA.
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