

Discover a new world of Superabrasives **Science and Engineering**



It takes industry expertise, in-depth scientific research and analysis, careful engineering, and a state-of-the-art suite of tools to design the next generation of superabrasive products.

That's why we've been busy creating the Superabrasives Process Optimization Centre (or S.P.O.C. for short). S.P.O.C. is the result of our commitment to customers' demands for unparalleled efficiencies and analytical data that is crucial to developing optimized superabrasive products and tools that perform at the highest level possible.

Comprising of a data driven Materials Characterization Laboratory and a revolutionary Virtual Grinding Laboratory (allowing customers to take part in grinding experiments remotely, from anywhere in the world), the key purpose of S.P.O.C is to provide all the tools, comprehensive scientific analysis,

technical support and industry expertise you need to take your products and your company's potential to the next level.

Think of S.P.O.C. as your comprehensive ally in the superabrasives industry. S.P.O.C. is here to deliver the next generation of state-of-the-art testing technology to your fingertips. It is here to give your company a competitive edge in designing, optimizing, and implementing the best possible superabrasive products.

In short, S.P.O.C. is here to ensure nothing is left to chance. We've developed S.P.O.C. to ensure our customers have access to all the analytical data and industry leading expertise they need to tailor superior superabrasive products that are perfected for their intended purpose. So, let's take a closer look at what S.P.O.C. offers.

THE MATERIALS CHARACTERIZATION LABORATORY

Creating the next generation of high performing superabrasive products requires in-depth research and the ability to collect a wide range of scientific data. To stay at the forefront of the industry, we have created an extremely powerful analytical center – the Materials Characterization Laboratory.

Within our Materials Characterization Laboratory you'll find a suite of industry-leading tools that can be used to collect all the data you'll need to design the perfect superabrasive products for your needs.

Each tool has been selected for its powerful analytical performance and data collection abilities. Combined, they will give you an unparalleled competitive edge in creating and tailoring the future

of your superabrasive products.

JEOL SEM WITH EDS CAPABILITIES

The JEOL low vacuum Scanning Electron Microscope with integrated Energy Dispersive X-Ray Spectroscopy is ideal for performing advanced analytical analysis. Utilizing the latest Silicon Drift Detector (SDD) technology, the JEOL SEM allows engineers, scientists, and technicians to carefully assess and analyze the morphology and elemental chemistry of superabrasive grains and their coatings.

The JEOL SEM has been carefully designed for ease of use, and the versatile InTouchScope has functions that users and customers of all abilities will be happy with. Key features include:

- Automatic SEM condition setup based on sample type
- Simultaneous multiple live image and movie capture
- Easy sample navigation at 5x – 300,000x magnifications
- Quantitative and qualitative elemental analysis
- Low and high vacuum operation
- Wireless capability
- Portable, compact, small footprint SEM

The InTouchScope features all the capabilities of a full size tungsten SEM with integrated EDS analysis in a small, ergonomic and intuitive design. An onboard turbo pump makes this a truly self-contained, portable SEM that is easy to set up anywhere in the lab.

KEYENCE VHX 2000 DIGITAL 3D MICROSCOPE

This extremely versatile and exceptionally handy all-in-one microscope system cleverly combines the capabilities of a conventional stereomicroscope, compound microscope, and metallurgical microscope.

Taking digital microscopy to new heights, the result of this innovative design is a single system that can observe, measure, and record. To further its performance, we have carefully developed a customized mounting system to allow us to take images of the wheel on the spindle.

This added feature lets us characterize the wear progression of abrasive grains. We can measure grit exposure / pull out, wear flats and bond erosion, which are all critical to comprehensive performance evaluation.

Key features of the Keyence VHX 2000 Digital Microscope include:

- 0.1x – 5,000x magnification range
- Incredibly large depth-of-field (inspect from any angle and perform 2D/3D observation and measurement)
- Can identify optimal bond / crystal combinations by generating in-process color images of the tool's bond / crystal wear characteristics down to 1 micron

SONOSCAN D9600 ACOUSTIC EMISSION MICROSCOPE

At the very forefront of C-SAM acoustic micro imaging systems, the Sonoscan D9600 is the perfect general purpose tool for failure analysis, process development, material characterization and low volume product inspection.

Using high-frequency, non-destructive sound waves, we can utilize the Sonoscan D9600 to produce an accurate image of solid and porous samples. The performance levels of the D9600 are truly unrivaled on the market.

Key features include:

- PolyGate™ technology with Multi-Gate™ and Probing-Gate™ functions capable of single and multi-focus imaging
- Set up to 100 gates per channel
- Windows® 7 Ultimate for multi-language and 64 bit capabilities
- Linear Motor Scanner
- Enhanced precision with tower mounted scan reference platform and sample fixture
- Easy-access scanning area makes loading and unloading easier
- Quantitative B-Scan Analysis Mode (Q-BAM)™ incorporates Sonoscan's proprietary B-Scan mode to provide a virtual cross-sectional view with accurate polarity, amplitude and depth data
- Optional water recirculation, Water-

fall™ Transducer and inline temperature control

- Optional Digital Image Analysis (DIA)™ uses advanced algorithms to quantify acoustic data, allowing you to set accurate, automatic, accept/reject criteria

With incredible accuracy and an extremely robust design, the Sonoscan D9600 includes enhanced electronics and software technology that puts it at the top of the performance level list for laboratory acoustic microscopes. Its innovative capabilities are the reason it has earned a place in our high-tech Materials Characterization Laboratory.

PROTO LXR D RESIDUAL STRESS MAPPING MACHINE

The Proto LXR D is manufactured by the leading name in residual stress mapping and is the perfect tool to use where residual stress is a concern for critical fatigue components. Utilizing sophisticated x-ray technology and enhanced detection software this tool provides unparalleled accuracy.

Our Materials Characterization Laboratory uses the Proto LXR D to carefully measure the levels of material stress after grind to provide a closed-loop grinding evaluation.

Key features include:

- Robust, heavy-duty design Primed for industrial use
- Fast, durable x-ray detectors that do not deteriorate over time
- Unique modular goniometer system (patent pending)
- Advanced onboard chiller / heater to maintain optimum performance
- X-ray tubes
- Wide range of x-ray apertures to enable measurement of odd-shaped parts
- The latest XRDWin 2.0 software for unparalleled data collection and accurate residual stress analysis

UNITING THE MOST SOPHISTICATED DATA COLLECTION TOOLS

Our world-class state-of-the-art Materials Characterization Laboratory is carefully



The Keyence VHX 2000 Digital 3D microscope's customized mounting system allows us to take images of the wheel on the spindle.

comprised of the latest industry-leading tools to provide an unmatched analytical and data collection center that is capable of performing in-depth measurement of all aspects of superabrasives.

With our Materials Characterization Laboratory we guarantee that you will never leave anything to chance. All bases of research, experimentation, analysis, optimization and development have been covered.

Our new and highly sophisticated line of tools available in our Materials Characterization Laboratory highlights and showcases why we are at the forefront of the superabrasives industry, and by utilizing all the features and analytic potential of our laboratory, you'll be able to be at the forefront of your industry too.

THE VIRTUAL GRINDING LABORATORY (VGL)

Being at the peak of the superabrasives industry requires setting the bar for innovation and customer satisfaction.

Well, we've taken our reigns as leaders and have done just that with our forward-thinking Virtual Grinding Laboratory.

This world-class, versatile testing platform for superabrasive tools allows customers from all over the world to directly and interactively control grinding experiments from the comfort of their own premises.

That's right, there is no need to travel hundreds or thousands of miles to get involved. Instead, via the Citrix Go-To Meeting video conferencing platform customers have the ability to control grinding experiments from anywhere in the world.

THE TECHNOLOGY BEHIND THE VGL

The key component of the VGL is an ANCA RX-7 grinding machine. This 5-axis grinding machine has separate chilled grinding fluid delivery systems that are capable of delivering both water based coolant or mineral oil.

The VGL also offers three types of grinding kinematics:

- Surface / creep feed grinding
- Cylindrical Grinding (OD)
- Tool and cutter

Overall, the VGL consists of a fully instrumented grinding machine, post-grind surface measurement capability, and remote access of in-process and post-process signals and data.

We have also partnered with the highly regarded Dr John Webster of Cool-Grind Technologies, LLC to enhance and optimize the dual chilled coolant delivery system of the ANCA RX-7.

Fully Interact With Grinding Technicians

One of the key features of the VGL is the ability for the end-user to fully interact with grinding technicians for the duration of the grinding experiment. Customers can directly interact with our engineers to evaluate and optimize



The Proto LXR carefully measures the levels of material stress after grind to provide a closed-loop grinding evaluation.

the performance of their superabrasive products.

Customers can, in real-time, visually see, instruct, and interact with highly experienced grinding technicians throughout the whole testing process. On top of this, customers will also have full access to view the live data being produced by the ANCA RX-7 grinding machine, ensuring that any superabrasive products can be fully optimized and tailored to their requirements.

Gain a Competitive Edge

Here at Worldwide Superabrasives we firmly encourage competitive industrial research as we believe that this sort of research is the basis for product innovation and pushing the industry to new heights.

Unlike university and government grinding laboratories, all testing at the VGL can be carried out in complete confidence. Tests can conveniently be performed on-demand for a fee and all results do not need to be publishable. This means that all data produced is

strictly confidential, and to ensure this, all remote experiments are carried out over a highly secure network connection.

It is this approach to research and testing that gives customers a competitive edge in the industry and encourages them to keep testing, refining, and enhancing their products to be the best the market has to offer. We believe that everyone should be entitled to put in the hard work to gain a competitive edge in the industry.

The Capabilities Of The VGL Instrumented Grinding Test Bed

The VGL is designed to be a powerful tool for providing a precise and repeatable data measurement system. The following is a clear and concise sample of the capabilities of the VGL:

Key Test Bed Characteristics

- Surface Grinding (Pendulum and Creep-Feed)
- Cylindrical Grinding (OD)
- Water Based Coolant Delivery and

- Filtration System with Chiller
- Oil Based Coolant Delivery and Filtration System with Chiller
- Engineered Coolant Delivery and Nozzle System
- Known Static and Dynamic Machine Characteristics
- In-Process Instrumentation
- Post-Process Instrumentation
- Advanced Graphical and Analytical Analysis of Grinding Data

Static and Dynamic Machine Characteristics

- Measured Relative Static Stiffness between Workpiece and Grinding Wheel
- Measured Relative FRF (Frequency Response Function) between Workpiece and Grinding Wheel

In-Process Measurements

- Normal Force
- Tangential Force
- Grinding Spindle Power
- AE (Acoustic Emission)
- Coolant Pressure (For Calculation of Coolant Jet Velocity)

Post-Process Measurements

- Workpiece Surface Finish
- Workpiece Surface Integrity
- Grinding Wheel Wear
- Grinding Wheel Surface Topography
- Abrasive Grain Wear

Grinding Data Analysis

- ΔW - Work Removal Parameter
- Q_w' - Specific Material Removal Rate
- P' - Specific Power
- e_c - Specific Grinding Energy
- G-ratio
- ΔS - Wheel Removal Parameter
- Q_s' - Specific Wheel Removal Rate

Having all of this data to hand, along with all the available tools in the Material Characterization Laboratory, really does make S.P.O.C. the pinnacle of superabrasive research, development, and product refinement.

S.P.O.C. – Helping You Engineer Tomorrow's Superabrasive Products Today

In summary, S.P.O.C. was created from the ground up with the needs of our customers and the industry as a whole in mind. To keep moving forward innovation is needed, and this innovation can be achieved with the tools and services available in our Material Characterization Laboratory and Virtual Grinding Laboratory.

Never has it been easier for customers to optimize and tailor the perfect superabrasive products and superabrasive tools. Every aspect can be rigorously

tested and evaluated by utilizing the suite of tools available in both of our laboratories.

The Material Characterization Laboratory and the Virtual Grinding Laboratory provide unparalleled levels of data collection, and unlike government and university laboratories, this data does not need to be published and is completely confidential to the end-user.

If you want your company to lead the industry by developing and enhancing its products then S.P.O.C. is the answer you've been looking for. It's the only place where a world-class grinding plat-

form and world-class Material Characterization Laboratory combine to give precise, world-class data measurement capabilities and in-depth analysis like never before.

Want To Find Out More?

Then don't hesitate to get in touch with us today for more information. We can easily be contacted using the following details:

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