SURFACING SCIENCE™

www.universalphotonics.com EMAIL: info@universalphotonics.com UNIVERSAL PHOTONICS ADVANCED SURFACING PRODUCTS & TECHNOLOGY VOLUME 4

GLOBAL HEADQUARTERS
UNIVERSAL PHOTONICS INCORPORATED
85 Jetson Lane
Central Islip, NY 11722 USA
T: 516.935.4000
F: 516.935.4039

DISTRIBUTION FACILITIES
New York • California • Hong Kong

MANUFACTURING FACILITIES
85 Jetson Lane
Central Islip, NY 11722 USA
T: 516.935.4000

10 Ward Street
Vernon, New York 13476 USA
T: 315.829.3600

FAR EAST OFFICES

JAPAN: TOKYO
T: +81 3 6205 4121

CHINA: NANJING
T: +86 25 5287 6893

CHINA: SHENZHEN
T: +86 755 2584 9294

HONG KONG
T: +852 9456 8628

KOREA
T: +82 31 217 5873

TAIWAN
T: +886 6505 2996

Nanoscience Eliminates Surface Reflection with INVISIBLE GLASS

The sun is shining and working outdoors is a welcome option, but open the laptop and realize you can hardly see a thing. Might as well ditch work. Take some cool pics with your smartphone. Guess what? Can't make out the interactive display. And watch a video? Nope. Just picking up your own silhouette in the screen. Wouldn't it be great if someone developed a non-glare glass?

Well the folks over at the Center for Functional Nanomaterials (CFN) at Brookhaven National Laboratory, New York, have done just that, creating a textured coating for glass that impairs the refractive index, thereby preventing the reflection of light. They claim that their nano-coating will stop reflections in the 450 to 2,000 nanometer range, which includes both visible and infrared light, and the effect is the same from off-center angles.

Light reflection is the result of a change in the refractive index, a measure of how much a ray of light bends as it crosses from one material to another. The nanoscale features of this coating cause the refractive index to change, gradually reducing reflections so much that the glass becomes invisible. While there are other types of reflection-killing coatings, most anti-glare products are only effective at one viewing angle and wavelength of light. Developers looked to nature, and more particularly at insect eyes and wings, since for predatory protection their surfaces do not reflect light. Mimicking these anti-glare molecules allows a larger spectra of light without refraction while maintaining wider transparency at off-center angles. Eureka, invisible glass!

Non-reflective glass will not only benefit consumer electronics, it could be a game changer for solar energy by minimizing the amount of sunlight lost to reflection. It is also a better alternative for pulsed-laser applications, such as those applied to medical devices and aerospace components. As invisible glass is further explored, its use in large scale manufacturing is assured.

OPTICS INDUSTRY ON THE MOVE

Larger Polishing Operations Rely on Hi-Performance, Low Maintenance Machinery

With competition heating up, companies look to invest in equipment that will perform to application specs with little to no downtime and that are built to last. Take a look at the **UNAJEC 52" Overarm.** With a relatively small footprint, the 52" table of this powerhouse machine is supported on tapered roller bearings for increased load capacity and longevity. A quick disconnect of the eccentric link allows a swing-away overarm for easy on/off loading. The main table spindle assembly and eccentric spindle are lubricated for life, making them virtually maintenance free and assuring continual top performance. This heavy duty overarm can be built to order with features customized to meet application needs.

WHAT'S NEW...

pH & SLURRY

Controlling pH is important to maintaining the consistent performance of polishing slurry. Here's why...

Page 2

COLOSSAL CNC GROOVER

Delivering the latest pad configurations required by OEMs of large optics systems.

Page 3

RESULTS ARE IN...

HASTILITE FIN

Achieves ***HIGHER*** *removal rate in less time, with* ***BEST*** *surface finish* - Surpasses leading competitor. To learn more about this technically advanced CeO_2 polishing slurry contact a UPI Applications Engineer.

Ask An Expert: ON-SITE Q&A

Application engineers & polish technicians are on hand at every UPI/NUVITE trade show to address all surfacing questions.
For upcoming shows:
universalphotonics.com/events
nuvitechemical.com/events

NUVITE TRAVELS TO SHANGHAI

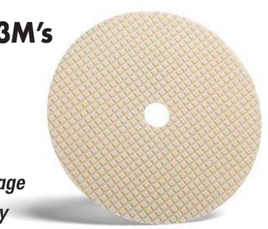
China's Growing Air Travel demands Aircraft Maintenance that is thorough & speedy

NUVITE Chemical Compounds, a subsidiary of **UNIVERSAL PHOTONICS**, joined with **TengLong Aerospace Equipment & Services Company** to exhibit at the *5th Annual Shanghai International MRO Exhibition, (MRO China, 2018)*. Attracting more than 10,000 attendees, including buyers and suppliers from over 40 countries, industry leaders, domestic airline executives, and PRC government officials, the summit focused on industry topics like: aircraft appearance maintenance, engine maintenance technology, interior innovations, electronics and information technology, training and service, among other necessary aviation operations.

The exhibition speaks to the rapid growth of China's aviation market. An aviation market is defined as traffic to, from, and within a country and according to the International Air Transport Association, IATA, China will displace the U.S.A as the world's largest by 2022, two years sooner than previously expected. Driving this is China's growing middle class anxious for domestic and international travel and targeted to hit 1.5 billion passengers by 2036. To accommodate, the industry is gearing up with forecasts for 7,000

...Continued on page 2

UPI Welcomes 3M's TRIZACT™ Diamond Tile



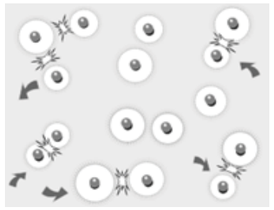
- *Faster cut rates*
- *Less subsurface damage*
- *Increased productivity*

UNIVERSAL PHOTONICS has signed on as the sole North American distributor for 3M's TRIZACT™ Diamond Tile (TDT) and in doing so offers another powerful tool not only to remove material faster than coarse slurries or fixed pellets and with less subsurface damage, but to do so without the messy residue of slurry lapping. Used commercially to lap a wide variety of hard ceramics and brittle substrates like fused quartz/silica, borosilicate optical glass, sapphire, and glass ceramics such as Zerodur™, TRIZACT™ Diamond Tile is an ideal solution for lapping a multitude of substrates on conventional single or double-sided lapping machines using water-based grinding coolants.

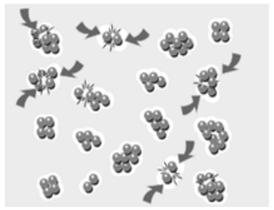
TRIZACT™ Diamond Tile grew out of the search for bonded fixed abrasives with longer life of finer grade products. Unlike conventional abrasives, superabrasives require a bond structure that is simultaneously rigid and flexible. TDT's fixed abrasive technology combines an organic

....Continued on page 3

pH & Polishing Slurry: *Understanding the Impact*



Charged Particles repel each other



Uncharged Particles collide & aggregate

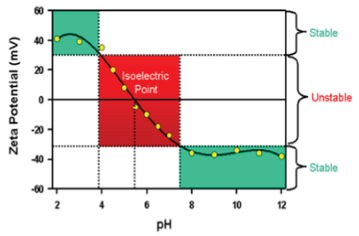
Maintaining a stable slurry during the polishing process ensures consistent results. And while pH is not the only factor to affect slurry stability, it has a critical role in dispersing particles that maximize surface contact and resist flocculating and settling out. To understand how pH impacts slurry and how to control it, let's look at the science.

Water is a polar liquid containing partial charges. When placed in water, an insoluble particle such as aluminum oxide or cerium oxide is energized by these partial charges. Balancing the surface charge of the particle is important to consistent slurry performance.

pH is a measurement of the amount of free positive, hydronium (H+) ions or negative, hydroxide (OH-) ion. The sum of these ions determine the pH of water. A pH below 7 indicates more H+ ions, while a pH above 7 has more OH- ions. An equal balance of H+ and OH- ions delivers a pH of 7. Often municipal water varies in pH from 6.5 - 8.5, the result of extra ions coming from dissolved minerals and gases such as calcium, iron and magnesium. These alter the H+ and OH- balance consequently affecting slurry performance.

The basic principle of magnetism is that like charges repel and opposite charges attract. For example, when alumina particles are in water their surface charge attracts a cloud of opposite charges (H+ or OH- ions); a.k.a. the electronic double layer. There is additional electric potential, called the zeta potential, at the interface of the particle's solid surface and the liquid medium. A strong positive or negative net charge at this interface will cause particles to repel each other. With little to no net charge at the interface, known as the isoelectric point, the particles will attract.

So how does pH affect the electric charge balance? A low pH slurry has excess hydronium ion that is available to counter balance or enhance the surface potential at the interface. Adding excess hydronium or hydroxide ions via acid or base will either increase or decrease the solid surface/liquid interface net charge, changing zeta potential. If the zeta potential is greater than + 30 mV, the particle charge is sufficient to repel particles, to stay dispersed and resist the formation of flocs and settling. Insufficient charge on the particle surface allows particles to collide and aggregate, typically resulting in hard packed particles at the bottom of the slurry tank.



Graph of zeta potential vs. pH showing colloidal stability of aluminum oxide particle in water.

Monitoring and controlling pH allows control of the net charge on the particle/liquid interface. Using DI water minimizes pH variations and consequently promotes stable slurry behavior.

pH, however, is not the only factor that affects slurry stability. Types of mixing equipment, surfactants/additives, solids concentration, viscosity, particle size, and particle type all contribute. These other factors will also influence dispersion and suspension of the slurry and should be optimized along with pH for the best polishing performance. For more information or to discuss unique processes, consult a UPI applications engineer.

From Left: Hong-Wen Ju (Howard), VP; Zhaoqing Lu (George), Project Manager; Robert McHugh (Bob), VP NUVITE Sales; Zhongkai Cai (Frankie) Business Development; Anyong Du (Duke) CEO, TengLong

NUVITE IN SHANGHAI

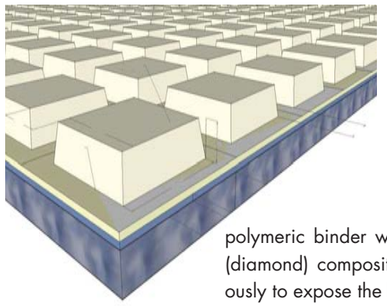
Demands for Thorough & Speedy Aircraft Maintenance

...Continued from page 1

new planes in the next 20 years and 135+ new airports on the mainland by 2025. For example, Daxing International Airport in Beijing, opening in late 2019, will be the world's largest airport with eight runways moving 100 million passengers yearly. While China's three largest commercial carriers grew more than 70% in the last several years, private jet ownership over the last decade is up a whopping 347% according to Forbes|Statista. This all tranlates into an increasing need for maintenance and detailing services on ever tightening schedules. Passengers should always board an attractive, clean aircraft with an immaculate interior. Likewise each leg of a flight requires housekeeping. Comprehensive exterior surface maintenance is usually scheduled every 30-45 days. With a decades long footprint in aviation, scheduled appearance maintenance operations are nothing new for **NUVITE**. So when **TengLong** called, our field application specialists were ready. Headquartered in Shenzhen, **TengLong Aerospace Equipment & Services Company** is parent to U.S. based **Reliable Aviation Services,** a full service aircraft detailer. **Reliable** was contracted earlier this year by **Deer Jet**, an aircraft management company controlling 70% of private and corporate aircraft in China, to handle their aircraft detailing business. Service agreements are in the works with **Hainan Airlines**, **China Eastern Air**, **Gulfstream,** and others. **TengLong** is positioned as a major MRO relying on **NUVITE** to service the China aviation market.

COLOSSAL CNC GROOVER EXPANDS PRODUCTION CAPABILITIES

The recent installation at UPI's Vernon, New York, LP Unalon manufacturing facility of a new CNC Groover, with a table size of 137" x 137", expands plant production capabilities on many fronts. Not only can it handle the increasing demand for much larger pad sizes, but it also delivers unique contours beyond the standard X & Y grid patterns. Concentric circles, spiral, and helix patterns are now possible with tighter groove depth tolerances. It is a welcome compliment to the oversized laminating machine installed at the plant last year, which handles the application of Pressure Sensitive Adhesive, PSA, to LP polishing material up to 96" wide. The new CNC Groover is projected to increase production throughput five to ten-fold.



3M's TRIZACT™ Diamond Tile

Available exclusively from UNIVERSAL PHOTONICS

...Continued from page 1

polymeric binder with an inorganic abrasive (diamond) composite multi-replicated continuously to expose the lower lying abrasive.

Fundamental to TRIZACT's™ fixed abrasive technology is abrasive conditioning with two separate and distinct operations. *Initial conditioning*, a.k.a. *pad break-in*, removes a thin layer from the surface exposing the fixed abrasives used for cutting. *Pad break-in* improves surface flatness and yields a stable substrate removal rate. For TDT, break-in wear is recommended between 40-75 microns. *Pad dressing* or pad *conditioning* happens throughout the life of the pad and is operation dependent. Ongoing conditioning determines pad wear amounts, which improve flatness and keep removal rates to appropriate levels. Factors affecting pad wear are diamond size, lapping machinery and conditions, substrate material, and total substrate removal.

A key advantage of TRIZACT™ is that low pressures can be used optimizing benefits. Lower pressures result in lower subsurface damage, while TDT's diamond abrasive still maintains higher removal rates. Lower pressures can also provide improved bow and warp on parts being processed, as well as improve overall flatness.

Conventional abrasives are hard-pressed to compete with diamond. Usually, higher cost is what prevents diamond use, but TRIZACT's™ fast, consistent cut rates, finer finishes, and reduced process time increase productivity and reduce cost.

3M's TRIZACT™ Diamond Tile is available in a variety of micron sizes, along with the silicon carbide pucks and boride stones used for conditioning. **UNIVERSAL PHOTONICS** also has a selection of water-based coolants to meet your application needs. For more information contact a UPI technical representative.

UPI SPOTLIGHT

Stanford's Futures in Engineering

Earlier this year Floyd McClung, Product Manager for **UNIVERSAL PHOTONICS**, added another professional title to his impressive resume. As Associate Director of Material Science & Engineering and Chemical Engineering at Stanford University in California, Floyd will manage *Futures in Engineering*, a program that partners the University with companies in a variety of industries. The partnership looks to explore research alliances, identify projects of mutual interest and highlight career opportunities.

Ranked #2 by *U.S. News & World Report*, Stanford's School of Engineering Program is at the forefront of groundbreaking research and innovation, attracting the best and brightest from all over the globe. Huge strides in technology, science, and computing have made engineering a top field, with the top five in-demand jobs in software, aerospace, civil engineering, environmental, and biomedical. And because most industry depends on the synthesis and processing of chemicals and materials, chemical engineers are also in demand. One thing is for sure, companies who become member affiliates in the *Futures in Engineering* program are certain to benefit with more than 600 students in engineering degree programs and a faculty invested in a variety of research areas. As Program Manager, Floyd will be instrumental in facilitating meaningful interaction between these groups with ongoing lectures on special topics, updating the news of technological advancements, and focusing on career development. While Floyd holds advanced degrees in Materials Science, Engineering and Business, his years of professional experience with global Fortune 500 companies in advanced optics, ceramic and metal polishing and coating applications make him perfectly suited for this latest venture. Fortunately, Floyd will also continue as Product Manager for **UNIVERSAL PHOTONICS**, supporting product creation, R&D, and developing unique application solutions. We congratulate Floyd and look forward to hearing more about the *Futures in Engineering* program.