SUPER-POLISH
Delivering Optics to Enable Cutting-Edge Applications

In the world of optical fabrication, Super-Polishing has the full attention of the precision optics industry. Engineered to overcome some of the disadvantages of conventional polishing, Super-Polish technology produces extremely smooth surfaces with roughness less than 1Å, over a wide power spectral density (PSD) band, which reduces scattered light and delivers higher efficiency. These resulting characteristics are critical for optical components used in X-ray technology, high precision lasers, photolithography, performance telescopes, and other applications. While Super-Polish gains notoriety for sub-angstrom proficiency, it does not have a standard industry-wide process. One widely used method is submerged polishing. In conventional polishing, optics mounted to a rotating spindle meet a lap moving back & forth polishing the surface. Abrasive slurries, adjusted based on particle size, are administered until a desired surface finish is achieved. Super-Polishing via the submerged technique, immerses the entire spindle/lap assembly into the polishing slurry. This protects the lap and optic from external contaminants that could damage the optical surface. Immersion also keeps the lap and optic at the same temperature, which improves shape consistency and promotes a smoother polished surface. Modifications to the submerged method include particle size distribution and monitoring slurry chemicals.

Super-Polish is used on a variety of hard materials like fused silica and sapphire. While most often the process is planned for plano optics, it can be performed on spherical or aspherical surfaces and generally on any optic size. Specially engineered for Super-Polishing operations, the 29" Submerged Continuous Polisher from UN-AJEC is all about achieving low roughness targets and higher efficiency. An enclosed, precisely regulated environment locks out contaminants and maintains the needed consistency critical to delivering superior surface quality. This polisher can run in submerged mode or with re-circulating slurry, with pitch or pad. Multiple workstation, a conditioner station, and stainless steel table are R/C controlled with touch screen HMIs to precisely set RPMs from 2-35. Quick release captures arms allow for easy loading and unloading and swing away for accessible maintenance of pitch surface. A manual sky hook and mounted plate lift the conditioner and work in tandem with the UNAJEC Flip Cart to allow flatness inspection on the conditioner. This heavy duty, virtually maintenance free polisher will run uninterrupted 24 hour polishing cycles. Customizable features, including size, are available.

SUBMERGED CONTINUOUS POLISHER
Intricate Polishing Operations Rely On High Precision Performance

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WHAT’S NEW...
Colloidal Silica
A commonly used abrasive, but with so many modifiable attributes, which is best for your application?

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ROBOTS & UAVs
From high-end sensors for visual inspections to aircraft cleaning, bats & drones are infiltrating aviation MROs.

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OPTICAL GLASS:
KEY TO AUTOMOTIVE INNOVATION
Properties of Optical Glass Deliver Efficiency & Performance to New Technologies

As the automotive industry looks to meet growing demands for road safety, driver as-
sist systems, and improved vehicle comfort & aesthetics, glass continues to be a favored ma-
terial for a number of reasons. Advancements in
glass fabrication are satisfying a wide variety of industry innovations with optics to guide, reflect, select, and alter light. Moreover, glass optics have distinct physical properties that align with exacting automotive requirements for reliability and long service life.

An innovative concept 15 years ago, automotive LED lighting has evolved to create new systems of illumination for both interior and exterior. Rear Combination Lights (RCL) were among the first to take advantage of concentrating refracted light as a single source or an array of low power de-
sengers. Relying on the high thermal resistance and low expansion properties of glass, LED chips are packaged as groups with ever-smaller gaps to achieve greater luminosity. Designers can get more creative. Just look at the wide variety of tail-
lights you see on the road today. Matrix LED headlights systems combine with cam-
era and image processing to control front light functions like glare-free and adaptive headlights. Adaptive Driving Beam (ADB) headlights keep high beams on while working in tandem with sensors. Objects in the road register as data, which processes to turn on/off altering light beams or dim various LED’s. There is no glare to oncoming traffic and the road is brightly and safely lit. There are a variety of automated lighting systems. Some use indirect reflectors to produce beams; others are building a complex matrix of high-definition pixels for greater visibil-
ity and control. Anticipating driverless vehicles,...

DryWash: Meeting the Future Today
The Benefits of Waterless Cleaning Technology

Rarely does a product have advantages to bene-
fit different market segments. DryWash is a deep cleaning technology that uses a chemical formu-
lation to remove soil/oils/grease, deodorize, enhance paint gloss, and provide a protective barrier against UV and other atmospheric condi-
tions - All without water. It has become increas-
ingly popular in the aviation industry, particularly since the elimination of water makes scheduling exterior cleaning flexible and convenient. During an eight-hour layover at a field base operation anywhere in the world, a full DryWash appli-
cation on a widebody aircraft facilitated in a hanger or on a ramp, can be completed while simultaneously undergoing other necessary main-
tenance activities. Moreover, DryWash can be adapted to surfaces by the water condition, and type of soil, making interim cleaning via area
Silica, aka silicon dioxide, is the most abundant compound in the Earth's crust, accounting for 59% of its mass. It is the main constituent of beach sand and is present in 95% of known rocks. Silica is a main component in glass, as well as in construction materials for roads and buildings. It is also the mineral source for the element silicon, which enables the development of computers and many of today's modern electronics.

Silica powder is often used abrasively in precision polishing. Industrially manufactured from synthetic amorphous silica, it can morph physical and chemical characteristics during the manufacturing process to yield different types of colloidal silica. The advantage is that varying attributes complement a variety of substrate applications. Understanding the science will help identify the right one for your polishing process.

A colloidal silica is a stable dispersion of particles small enough that gravity does not cause them to settle out. Colloidal silica particles are typically in the range of 5 to 120 nanometers [1000nm = 1µm]. The most common method for high-volume manufacturing of colloidal silica for industry is to alkali-silicate like sodium silicate. Using ion exchange, sodium is removed and replaced with hydrogen ions, forming silica acid. Without the sodium cation as a stabilizer, the particles begin to grow. Once the growth process is complete (heat and time), the final product is stabilized with additional chemical additives and concentrated to the desired content.

Colloidal silica is easily modified during the manufacturing process resulting in a variety of different products. For polishing, the properties most often modified are the median particle size, particle distribution, particle shape and particle charge. After the colloid is made, an additional chemical modification can take place. Surface chemistries (5-120 nm) are often very sensitive. If not managed properly, they can flocculate and settle out or even gel. Applying different surface chemistry can stabilize and make them usable in acidic, neutral or basic conditions. The most common colloidal silica slurry used for polishing optical materials has a pH of 4 to 9. Basix® pH stability surface chemistry, colloidal silica slurries can be designed for specific applications. They are often used in CMP (Chemical Mechanical Polishing/planarization) processes with additional chemistry to speed up surface removal rate. These chemical additives enhance colloidal silica slurries to polish hard substrates such as sapphire and silicon carbide.

With so many modifiable attributes - size, distribution, shape, chemistry - finding the right colloidal silica slurry is challenging. The most common have a pH of 9 to 10, and a median particle size between 50-80 nanometers. With either narrow or broad particle size distribution, this type of colloidal silica performs well in most optical polishing processes. For substrates like metal, a lower pH colloidal silica slurry might be a better choice. Harder substrates like sapphire or silicon carbide do better with a higher pH colloidal silica that has special chemical additives to enhance removal rate. Silicon, gallium arsenide, gallium nitrite, and other like substrates may require specific colloidal silica slurries for best results.

NUVITE Chemical Compounds offers a selection of high-quality DryWash Waterless Cleaning Technology products. Choose from NuPol, NuPower II, Citri Cut Xtra, or NuClean. The NuPol is a pre-rinse, neutral condition, protect, enhance and improve the longevity of your aircraft’s appearance, each has attributes to meet specific surface conditions. Contact an applications engineer to find which NUVITE DryWash will deliver the best results for you.

BOTS

Automation via robotics and UAV’s has infiltrated industry worldwide. While robots have been on the automotive production line for decades, the technology has had a much slower build in aviation. Partly due to high safety standards and lower manufacturing volumes, robotics [both] showed up only a few years ago on the production floor, charged with repetitive riveting of Boeing’s fuselage sections and hole-drilling for Airbus. Today, robots continue to inch their way into aircraft Maintenance, Repair & Overhaul (MRO) operations. As the technologies improve, the list of suitable tasks for both grows. And as the production environment changes, so do the growing capabilities of robotic fabrication to realize unique, branded designs.

Many innovations we see today, from the standpoint of driver assist systems and comfort, are being rolled out on premium vehicles,” says Troy Alley, Sr. Applications Engineer of UNIVERSAL PHOTONICS. “Cost may be a factor, but as production catches up with technology we’ll see subsequent cars with the latest equipment as well.” Mr. Alley also represents UPiS’ North American distributorship of CDGM, the world’s largest producer of optical glass. The CDGM portfolio has 240+ types of glass in a wide variety of forms, as well as specialty glass for lighting, electronics, and custom applications.

OPTICAL GLASS & AUTOMOTIVE: Meeting the Challenges of New Technologies

m MEMS-based system will consider lasers. These systems all use an LED light source and rely on components with high transmission, making optical glass an excellent material choice. High-precision glass is malleable with seemingly unlimited configurations. Many automotive applications rely on high-precision glass molding technology for the wide variety of aspheric lenses the process produces. LED, laser lighting, pico-projector lenses, Head-Up Displays (HUD), infrared devices, video surveillance (CCTV) and more are developed using aspheric lenses from different types of optical glass. From LED to fiber optic technology, optical glass is redefining functional and ambient light to both assist and enhance the driving experience. Instrument panels, map lights, center consoles, door panels and exterior signage lighting depend on the growing capabilities of optic fabrication to realize unique, branded designs.

As driver assist systems become intrinsic to our driving culture and autonomous vehicles take to the road, reliability is key. Blind spot detection, pre-crash warning, parking assist, lane departure, night vision, adaptive cruise control, intelligent light control, and traffic sign recognition rely on the performance of a multitude of optical components. Fortunately, optical glass has good chemical resistance and is immune to many aging factors like corrosion and yellowing, assuring assisted systems extend life.

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