At the Media-Tech Expo, Long Beach, USA (May 15-17) SINGULUS MASTERING will present its youngest family member: The CRYSTALLINE.

The new inline platform offers mass production capability of HD DVD, BD and DVD masters. With the CRYSTALLINE the new SINGULUS MASTERING proprietary Phase Transition Mastering (PTM) process is introduced.
CRYSTALLINE: Inline

The CRYSTALLINE system is a fully automated inline mastering platform, based on the "fresh glass substrate in - finished master out" principle. The system is a Class 100 cleanroom in itself with all process stations integrated, thereby avoiding the construction of a real and expensive cleanroom.

The robot disc handler at the center of the system has proven its speed, flexibility and reliability in the semiconductor industry. Running the system in unattended mode and also anticipating higher recording speeds, the CRYSTALLINE is equipped with a substrate warehouse.

Dynamic modeling and simulation have been applied for the mechanical design of the new Laser Beam Recorder (LBR). Fundamental new principles include the implementation of a new ultra-precise translation system, consisting of a linear motor, an optical scale (1 nm resolution) and servo-control, and the Learning Feed Forward Focus control.
CRYSTALLINE: PTM
Phase Transition Mastering

Essentially new in the recording of a PTM layer is that heat is induced to the sensitive layer of the substrate. In the photoresist process the sensitive layer is only exposed by the laser. Heating of the PTM layer is done with the same 405 nm diode laser diode that has been successfully used for many years for CD / DVD mastering with photoresist.

The CRYSTALLINE platform contains a “single chamber – three target” sputtering unit developed by SINGULUS TECHNOLOGIES, known as the specialist in the development of sputtering technologies. The PTM sputtering module applies the SINGULUS’ SmartCathode® principle to obtain maximum layer thickness uniformity.

CRYSTALLINE: Multi-format:
HD DVD, BD & DVD

The CRYSTALLINE is primarily designed for HD DVD and BD mastering, offering maximum flexibility independent of which format is required to serve the market. The DVD format can be mastered as well enabling a smooth transition into the new generation formats with a ramping up demand.

The CRYSTALLINE will be officially unveiled on Monday, May 14, 5:00 pm at the Long Beach Convention Center.
Dual layer Technology
To give the Blu-ray Disc a large capacity capability, SINGULUS cooperates with Sony DADC, Salzburg, in further developing the production technology for the mass production of Blu-ray dual layer Discs with a storage capacity of 50 GB. The good cooperation with Sony DADC offers SINGULUS a big opportunity to establish itself even faster in the market for the new disc formats as the leading partner of the Hollywood studios demand and to gain enormous competitive advantages. SINGULUS will launch the wet-embossing based dual layer module later this year and give all customers the option to upgrade their installed BLU-LINE to dual layer media.

SINGULUS BLU-LINE
The Solution for BD 50
The BLU-LINE from SINGULUS with a flexible machine size and modular arrangement of process modules allows the media manufacturer to customize the system for the in-house process requirements. The procedure for upgrading a single layer BLU-LINE into a dual layer production line is easy and fast. SINGULUS TECHNOLOGIES has prepared a system which includes substrate molding, layer 0 metallization, high accurate spacer-layer application, layer 1 wet-embossing, layer 1 metallization, cover-layer application, hard-coating, label-side-coating and final inspection. The arrangement of the dual layer module is specially adjusted for the best and most cost efficient process to manufacture a dual layer disc. The BLU-LINE does include 2 different size systems from a 25GB single layer to a 50GB dual layer process. With this broad program we handle any Blu-ray Disc demand, starting from process development up to robust and high pace production of all Blu-ray media.
TAURUS PLUS Production Line for all Recordable Formats

The HamaTech TAURUS PLUS is a new generation disc replication system for the production of recordable CD and DVD (CD-R and DVDR) as well as HD DVD-R discs. The design is based on thirteen years of experience with HamaTech’s CD-R and DVDR programs. The TAURUS family of products continues this successful story.

TAURUS PLUS
The HamaTech TAURUS PLUS is an innovative replication line, dedicated for mass production of CD-R and DVDR on the same production platform. The key features are:
- High quality CD-R and DVDR production on the same line
- CD-R production at 1.6 sec cycle time
- DVDR production at 1.8 sec cycle time
- Standard 2 IMM interface, 3rd IMM Interface optionally available
- Easy CD-R to DVDR line conversion
- OEM customer proven high quality system and components

With all options and following the optimized setup, the TAURUS PLUS allows for:
- CDR production with up to three injection molding machines that results in typical output values of:
  - more than 45,000 good CD-R/24hrs (OEM quality level) and
  - more than 50,000 sellable CD-R/24hrs.
- DVDR manufacturing with up to two injection molding machines that result in typical output values of:
  - more than 28,000 good DVDR/24hrs (OEM quality level) and
  - more than 30,000 sellable DVDR/24hrs.

The TAURUS PLUS machine is a “future-proof” system for recordable markets who demand the flexibility of swapping production capacity from CD-R to DVDR without compromising the OEM quality level of each product.

With its high level of process stability, the TAURUS platform is the leading system for recordable manufacturing.

HamaTech Service

The major project for SINGULUS Service this year has been the integration of the HamaTech customer support into the SINGULUS Business Unit Customer Service. The incorporation of HamaTech spare parts into SINGULUS headquarters’ stock and data system is 90% accomplished. A systematic approach was necessary to integrate 12,000 HamaTech parts into an existing stock volume of 30,000 parts at SINGULUS.

Roberto Calleja, Head of Business Unit Customer Service, said: "This was and still is a real challenge which the entire Service staff has embraced with great enthusiasm. We are pleased to be able to offer Service out of one central location." SINGULUS Service is able to provide technical and hotline service to SINGULUS and HamaTech customers!

As a special service, SINGULUS now offers its customers a 24 hours, 7 days Help Desk for all technical related questions.
As the leading equipment supplier for CD and DVD formats with a global market share of more than 65%, the Kahl am Main-based SINGULUS TECHNOLOGIES is proud to present a further enlargement of its product portfolio. The new SKYLINE II Duplex HD – originally designed for CD and DVD 5 media replication – is now able to manufacture in addition HD DVD single layer formats. In combination with the SPACELINE II – the benchmark in Dual Layer DVD and HD DVD production – and the SINGULUS injection molding machines of type MOLDPRO and EMOULD, a complete family of HD DVD production equipment is available.

Since the presentation of the SKYLINE II to the public in 2003, this production tool was able to tie up seamless to the track record of its successor SKYLINE I. Out of more than 1900 worldwide installed SKYLINE systems, more than 500 lines are of type SKYLINE II. Being recognized as the working horse within the replication industry, the market share of the SKYLINE II surpassed the above mentioned benchmark like SPACELINE II also did.

Differences to SPACELINE II
Whereas SPACELINE II is designed to manufacture DVD 5, DVD 9, DVD 10 and HD DVD (single and dual layer formats), the SKYLINE II

SKYLINE II Duplex HD
Now ready for Single Layer HD DVD Production
Together with SPACELINE II a Complete Family of Production Lines for All Single and Dual Layer DVD & HD DVD Formats
Duplex HD is prepared for CD, DVD5 and HD DVD single layer production. Besides that SPACELINE II is equipped with additional devices to enable the manufacturing of dual layer formats, SKYLINE II can easily be identified as a member of the SINGULUS family of replication equipment.

**Consistency facts**

As most SINGULUS customers are using SKYLINE II and SPACELINE II equipment in parallel, one of the main objectives for SINGULUS’ engineers has been, to consider the implementation of non-variable parts on both type of lines. Therefore these customers do benefit from a remarkable reduction on the amount and costs of spare parts within their stocks, generally increasing their availability in parallel.

Also the visualization was designed identically on both lines, allowing a fast transfer and reduced training for operating personnel. This includes a single-push-button solution enabling a quick switch between the formats to be manufactured. Therefore in most cases only a stamper change is necessary. Freely configurable parameter sets do provide best support to prepare a format exchange, reduce the conversion time and increase the uptime.

**Outlook**

Of course both SKYLINE II and SPACELINE II do achieve the most cost-efficient disc production, highest product quality and yield available in the market. Based on this measures and paired with its capabilities in manufacturing HD DVD formats, it is predicted that both replication lines will remain the benchmark within the industry.
Since the decision in 2002 to enter the new business area of thin film deposition tools for magneto-electronic applications, SINGULUS has manufactured six of their TIMARIS PVD bridge tools (wafer size up to 300mm diameter). Besides MRAM technology SINGULUS has qualified the TIMARIS for other applications, especially as a production tool for Thin Film Heads (TFHs) required in Hard Disk Drives (HDD). SINGULUS is also cooperating with Qimonda to qualify the TIMARIS for a standard semiconductor application in the frame of the SEA-NET project, a European-funded integrated project including 27 industrial and institutional partners. All applications require the deposit of ultra-thin metallic and insulating films and film stacks down to nanometer thickness and below with extremely high requirements regarding thickness and material uniformities.

The special capabilities of the TIMARIS and the addressed market for this type of machine have led to the decision to give the respective business unit inside of SINGULUS the name “Nano - Deposition - Technologies” (NDT).

The Multi-Target-Module (MTM) as key component of the TIMARIS PVD tool incorporates Linear Dynamic Deposition (LDD) technology in combination with ten (10) sputter targets in one vacuum chamber. This technology is especially designed for deposition of ultra-thin films, magnetic films, high-quality metallic, conductive and insulating films and multiple film stack deposition comprising these materials without needing to break the ultra-high vacuum. The LDD technology is the key to deliver world class material uniformity across large wafers and exceptional precise control of ultra thin layer thickness down to 1% of a nanometer. SINGULUS’ TIMARIS system is designed as a flexible cluster tool. Additional modules to the MTM are available to configure a complete machine according to the customers specifications. These modules are the Oxidation module, Soft-Etch module, Combi-module, and Static PVD module. Further modules are under development. The latest version of the MTM incorporates the full scope of sputtering techniques: DC magnetron sputtering, pulsed DC magnetron sputtering, RF magnetron and diode sputtering as well as combinations of it are selectable by recipe. Substrate bias is offered as an option.

In 2006, SINGULUS announced the sale of four TIMARIS thin-film deposition system for MRAM wafer production & Thin Film Head Applications. Two of these TIMARIS systems have passed their technical acceptance in Q1 of this year. Another TIMARIS system has been sold and is now delivered to GRANDIS in Silicon Valley/USA for the MRAM application. As part of the purchase contract, Grandis & SINGULUS signed an agreement to jointly develop advanced TMR films for MRAM based on the Spin-Torque - Transfer Technology (STT).

The goal is to replace the volatile DRAM by MRAM and to use MRAM as embedded memory in several applications. The cooperation with Grandis will ensure that Singulus NDT is involved in the very promising STT technology development.

Thin Film Heads (TFH)
- High Moment Material (Writer-Material)
- TMR (Reader Material)
- GMR (Reader Material)
- Deposition of seed and gap layers

Semiconductor
- MRAM
- HK Dielectrics
- Metal Gates
- Phase Change material deposition
- Deposition of EUV mirrors (Extreme Ultra - Violet) for next generation of lithography
- SAW/BAW film deposition

At Semicon West, the largest capital equipment exhibition show worldwide (in San Francisco from July 16-20, 2007), the SINGULUS Nano Deposition Technologies Group will display its activities to its customers.
HamaTech’s Advanced Process Equipment (APE) division provides photomask and wafer processing equipment & solutions for the worldwide semiconductor industry. The business activities of this division were transferred to an independent legal entity. As a member of the SINGULUS Group, HamaTech APE will look into potential synergies and benefits of the overall company’s network, especially with SINGULUS’ Nano Deposition Technologies (NDT) division. HamaTech APE has expanded its leading role for equipment for the cleaning and processing of photo masks; its global market share in these sub-segments is to more than 30%.

As technology of integrated circuits (ICs) evolves to ever shrinking dimensions, the manufacturing of photomasks becomes more and more challenging. For HamaTech APE with its expertise in photomask cleaning, developing and baking these increasing demands provide the opportunity to differentiate itself from its competitors by offering leading solutions for its customers. Six out of the top ten semiconductor companies, and all three major merchant mask manufacturers are customers of HamaTech APE, giving it access to develop leading technologies with them. A Joint Development Program on EUV and optical blank and mask cleaning with SEMATECH, a semiconductor consortium of renowned chip producers like Intel, IBM, TI, Freescale, Samsung, and others, is of high strategic importance. This cooperation enables HamaTech APE to address already today the future requirements of cleaning, leading to an excellent competitive position for HamaTech APE’s most advanced MaskTrack® cleaners.

Overall, well over 10 MaskTrack® systems as well as several other equipments were delivered to leading customers in the business year 2006, and well over 20 systems have been ordered by customers by Q1/2007. Combined with the exclusive customer portfolio this proves the great success of the MaskTrack® product introduced only in 2005. The majority of these equipments are used in mask cleaning, where today the most severe challenges exist for the demands of 65 and 45nm chip technologies: Such cleaning has to be accomplished without leaving a single particle of a critical size (e.g. 60 nm) on the mask surface, while at the same time the structure of similar size must not be damaged, optical properties may not be altered, and any chemical traces on the mask surface must be avoided.
OPTICUS - For Coating of Eyeglass Lenses
First Time at the MIDO in Milan

SINGULUS presented its innovative inline ophthalmic lens coating machine OPTICUS at the MIDO in Milan from May 4 to May 7. This was the first time that the machine was operating on display at a show. Visitors were able to view the machine that will revolutionize traditional eye lens production. SINGULUS’ proven inline coating process stems from the inline production of CDs and DVDs and automates the production process, considerably reducing personnel and logistics requirements as well as other expenses.

Dr. Steffen Runkel, Technical Director Optical Coatings, comments: “We are happy to present our OPTICUS coating machine for the first time to the tradeshow in Milan. This marks another milestone in the introduction of this new machine concept to the market.”

SINGULUS achieved an important breakthrough with this machine concept last December, when the first OPTICUS coating machine for plastic ophthalmic lenses was qualified for production and technically accepted by a customer. In total, three machines were delivered in 2006, which are employed in pilot production and daily mass production of eyeglass lenses.

Dr. Runkel adds: “The fruitful cooperation with several renowned eyeglass producers and the resulting exchange of know-how was a great help to the development of the machine, and strengthens our position in the eyeglass market.”
In November 2005, SINGULUS had introduced the metallization system SINGULUS 3DS, an innovative machine for decorative vacuum coating of plastic parts. This machine is a revolutionary new development in the segment of metallisation for complex plastic surfaces. With the sputtering process used in the SINGULUS 3DS, three-dimensional plastic parts can be handled and coated in vacuum with decorative metallic layers.

On the basis of the SINGULUS 3DS metallizer, a new system which integrates all necessary production steps from the injection molding machines to the metallization and the application of anti-scratch finishes was developed: the DECOLINE. All production processes are completely automated.

The DECOLINE was developed in cooperation with Balda AG, Bad Oeynhausen in October 2006. In January, SINGULUS TECHNOLOGIES announced this cooperation to the public. The new production line for the processing of plastic covers for mobile phones, handheld game devices and other plastic parts will be marketed under the brand DECOLINE. Amongst electronic devices, the line provides many advantages in applications like packaging for cosmetics & personal care, toys, automobile industries, household appliances and many other applications.

The delivery to the key customer Balda will take place in May 2007.

The new DECOLINE will also be shown on the K show in Duesseldorf/Germany from October 24-31, 2007.
SINGULUS TRAINING
10 Years of Training Classes

During the last ten years, we have provided training to 7,235 participants in our training centers worldwide. With your continued feedback, we have designed programs that are presented on-site, incorporating intensive hands-on, practical experience. We have also tailored our instruction to the specific skill levels of your personnel.

In short, we have listened and improved our training strategy to better suit your needs and production schedules. Our specially structured and customized training courses will provide the content to meet your requirements.

We have experienced training instructors in the U.S., Asia, the Netherlands and Germany. Learn from the experts - in one of our in-house training classrooms or in your own facility - how best to improve the performance and uptime of your equipment and get ready for the high production demands of the season.

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Let us know your needs and we are pleased to prepare an offer for you.

Use the opportunity... be good - become better!