STREAMLINE II DVD R – Advanced Production System for all Recordable DVD-Formats

DVDR manufacturing enters into its second phase in terms of both technological demand and productivity. Sound understanding of all process parameters, a fast technology transfer and the availability of newest stampers, dye and drives as well as an up-to-date production system are essential to compete in that tempting market.

The production of recordable DVD is on a transition from mainly technology driven manufacturing of an emerging new optical data storage format towards cost driven mass production of the meanwhile mature and well accepted recording media DVD-R (G) and DVD+R. The disc sales price, however, can remain on an attractive level as long as always the newest high-end products with the fastest recording speed are produced and as long as the disc quality meets the highest quality standards. Today, 4x recording speed is a commodity and 8x recording speed is standard for DVD+R and DVD-R, while 16x recording speed is announced for DVD+R in the second half of this year.

On the other hand, the disc production costs can be significantly lowered using a reliable and highly productive DVDR manufacturing system of the newest generation. The STREAMLINE II from SINGULUS TECHNOLOGIES is the first system dedicated to the economical mass production of high performance DVD+R and DVD-R.

Extremely reproducible and stable in operation, the new, fast STREAMLINE II is a result of our profound R&D activities in all multiply interacting process areas from mastering via molding and dye technology towards metallization and bonding. Those research activities generate the expertise to design reliable and highly productive machines, to react quickly to new technological challenges and to extract all necessary production knowledge within shortest time to establish a continuous technology transfer into the disc production facilities.
The STREAMLINE II DVD R is prepared for a downstream cycle time of well below 3 seconds.

Its modular design allows generally the implementation of different options – even buffers and a third injection molding machine can be integrated. However, to maintain a high level of production stability and disc quality, we can recommend only an inline system with two injection molding machines, both running symmetrically with equivalent process conditions.

Extensive use of servo drives all over the machine guarantees reliable and stable operation with consistent results and a high production uptime.

Thermal equilibrium throughout the replication line, fast mechanical disc stabilization with help of spin-coolers, a fully integrated process air conditioning unit, a fast and homogeneous radiation drying station with tilt control, uniform sputtering throughout the target lifetime, conditioning steps to relax tensions after drying and metallizing, a thermally balanced bonding station and a UV curing station with tilt compensation and advanced eccentricity control all contribute to high production yield, superior disc quality and stability for actual and future recording speeds.

Beyond that, the modular STREAMLINE II DVD R is already prepared for the integration of all hardware and processes necessary to produce all dual layer recordable DVD formats.

STREAMLINE II CD-R
Mass Production System for CD-R

The STREAMLINE II CD-R is a new, fast and reliable manufacturing system for recordable CD. Taking advantage of the many years of production experience SINGULUS acquired with the popular first STREAMLINE, the new STREAMLINE II is designed for the integration of three injection molding machines and offers a downstream cycle time potential of less than 1.5 seconds.

Extremely reproducible and stable in operation, the fast STREAMLINE II is again a result of our profound R&D activities in all multiply interacting process areas from mastering via molding and dye technology towards metallization and bonding. Those research activities generate the expertise to design reliable and highly productive machines and to react quickly to new technological challenges. The modular design of the STREAMLINE II allows the integration of different options like buffer stations in the feed-in and finishing area or a laser disc marker.
The new Replication Line for all prerecorded DVD Formats

We took the results and experience gained from the installation of over 600 DVD production systems worldwide and built a new, better system.

As the leading supplier of replication equipment for CD and DVD SINGULUS TECHNOLOGIES presented at the Replitech USA 1997 the first DVD in-line replication system worldwide available. The SPACELINE is dedicated to the replication of all DVD formats: DVD 9, DVD 5 and DVD 10 as well as DVD+RDL and SACD.

Since that time over 600 DVD production systems worldwide from SINGULUS TECHNOLOGIES work day in day out in the production of DVD. The SINGULUS replication line SPACELINE is now replaced by its next generation. With the introduction of the new SPACELINE II, SINGULUS reacts to the market demand to have a faster, smaller and smarter line to meet best cost efficiency and a high daily output.

While the cycle time for the DVD system has been reduced from 3 seconds to 2.5 seconds, it incorporates the potential for additional improvements. The new machine provide an average daily production rate of up to 30,000 Discs and sets the future benchmark in DVD replication again, a new generation of components allowing enhanced functionality, are used in combination with highly improved ergonomics. This second generation of a full automatic DVD replication line is following the philosophy for the utilization of the most advanced and reliable servomotors available today. These drives of course are supported by extremely precise gear boxes.

Generally SINGULUS TECHNOLOGIES AG places its focus on this new line to reach the highest productivity in the market. To achieve these targets the molding equipment has to be chosen accordingly. Therefore SINGULUS recommends using the latest versions of high speed molding machines like EMOULD S2000, SUMITOMO SD40 or NETSTAL EJET in relation with an adequate set of DVD molds.

The design of the new SPACELINE II is prepared to future emerging DVD formats and represents therefore the optimum for all pre-recorded DVD formats.
SINGULUS is a young company with a remarkable success story. Founded in 1995, producing only a stand-alone CD metallizer, the company grew to become the world’s leading sup

It is our experience from many years in the optical disc business, that mastering is a key production step and that control of this technology is decisive for being a frontrunner in the industry. More and more customers chose to buy both replication and mastering equipment out of one hand. Therefore in 2001 SINGULUS TECHNOLOGIES acquired OMP BV in Best, The Netherlands as a first step.

A second important decision was the acquisition of ODME Mastering effective Jan 1st, 2004 as a further step to prepare for the future generation of optical disc formats. Under the name SINGULUS MASTERING the companies SINGULUS OMP and ODME have been united. This youngest member of the SINGULUS group incorporates unique competence and experience as well as a complete product portfolio for all existing mastering applications. Hans Ebinger together with Chris Boomaars will manage SINGULUS MASTERING. The former President of OMP, Dr. Hans Ebinger, who joined SINGULUS TECHNOLOGIES in 1997 to develop the multilayer sputtering machine MODULUS and to lead SINGULUS move into the rewritable optical disc formats serves as Chief Operations Officer. Chris Boomaars as Executive
Vice President Marketing & Sales. Chris has been Managing Director for all mastering related products at ODME and works since 1989 in the industry.

While CD and DVD were only replacing existing analogue technology for music or video storage, now a complete new generation of consumer electronic equipment is approaching. HDTV channels will broadcast high resolution video content, to be viewed on large screen monitors combined with surround sound. These components will form a home theatre with an entirely new level of audio-visual entertainment. Two formats, Blu Ray Disc and HD-DVD are competing to serve as the associated optical disc storage medium.

SINGULUS MASTERING can already today offer the required mastering equipment for blue laser discs. In cooperation with PHILIPS since the late 90s, a special high precision mastering system was developed. It was discovered, that Deep UV light, readily available with ample power in form of frequency doubled gas lasers, would be more than sufficient to achieve the 15 GB for HD-DVD or the up to 27 GB for Blu Ray Disc. This is a most important finding, as the 25 year experience of optical photoresist glass mastering is now applicable also for the next generation of optical discs. Indeed, the major players today consider to do their next generation mastering by means of light optics.

Today seven Deep UV recorders are operating successfully in leading laboratories around the world and a lot of experience has been collected. Many of the disc samples in the current format test phase are mastered on our system.

Meanwhile development work continues to push the limits of the Deep UV system even further. A special trick, the filling of the air gap between focusing lens and substrate with a liquid, allows to increase the numerical aperture of the system substantially and therefore reduces the writing spot size.

Over the coming years high density blue laser optical storage will make its way from the development laboratory to the consumer living room. New generation production equipment will be employed to manufacture these discs and there is certainly still a lot of development work to be done. Nevertheless, SINGULUS MASTERING is well positioned to support the SINGULUS TECHNOLOGIES group as well as our customers with the required mastering technology.
SINGULUS TECHNOLOGIES –
Business Models must be enhanced

The long-range goal of SINGULUS TECHNOLOGIES is becoming the globally synonymous with innovative systems and machines centered around select, highly-profitable areas of application in vacuum thin film technology.

Our reasoning is apparent: Technology-based business models have relatively typical life cycles. This holds true for the demand for optical data storage media from the CD to the current DVD to the emerging Blu-Ray disc, and to the profitability of the businesses to which they are tied. Despite the dynamic development of the DVD market, the technology itself is mature and the markets for DVD manufacturers, i.e., replicators, are in the midst of a consolidation trend. Nevertheless, the current growth in the DVD market is extraordinarily dynamic.

The new DVD recordable (DVD±R) and rewritable (DVD±RW/DVD-RAM) formats provide additional growth, and the third generation of optical-data-storage media (Blu-Ray, HD-DVD) will be accelerated by the introduction of digital high-definition television in Japan and the U.S.

Two years after the announcement of our technological venture into new areas of application, we can look back on the considerable progress made. Our TMR technology, which SINGULUS has worked tirelessly on since the beginning of 2002, has passed all trial runs and sample coatings successfully. Our advanced technological position in the field of vacuum thin film technology, which was derived from our core business and largely patented, made possible the transition from our core business into an entirely new arena: MRAM (magnetic-random-access-memory) technology! MRAM uses magnetic elements for the storage of data bits instead of an electrical charge. SINGULUS systems will become an important link in the value-added chain of supply for this new technology.
OPTICUS – Inline Coating System for Ophthalmic Lenses

The company’s second new business domain is ophthalmic lens coating. This involves the precise yet economical application of scratch-resistant and optically functional layers, i.e., vacuum layering systems that are much more cost-effective than conventional systems.

In close cooperation with our key customer Rupp+Hubrach, a renowned manufacturer of eyeglass lenses within the ESSILOR group, an in line coatingandsystems technology was developed for single substrates in which hard as well as multiple AR coatings are applied exclusively by means of vacuum thin film technology. This new combination of processing stages in the coating of ophthalmic lenses represents a true innovation and provides substantial benefits to customers.

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**BATCH PRODUCTION. Yesterday**
Technology for Ophthalmic Lens Production.
Process Time for Refinement: ~6-8 Hours

1. Shaping
2. Cleaning
3. Hard Coating
4. Drying
5. Tempering
6. AR Coating (Front side)
7. AR Coating (Back side)
8. Hydrophobic Coating
9. Quality Control

**INLINE PRODUCTION. Today**
Fully Automated Refinement of Eyeglass Lenses.
Process Time for Refinement: ~30 Minutes

1. Shaping
2. Cleaning
3. Hard Coating
4. AR Coating
5. Hydrophobic Coating
6. Quality Control
Targets and Masks – at SINGULUS TECHNOLOGIES AG

SINGULUS offers Targets and Masks tailor-made for all SINGULUS lines for optimized performance and target lifetime. Targets are available for all formats such as CD, DVD, CDR, DVDR and RW-formats.

Take advantage of Target materials that meet highest quality standards and target lifetime as well as masks from special copper and Copper alloy material that guarantee high adhesion to sputtered materials and stable production processes.

Buy “the original” Targets and Masks from the machine manufacturer to ensure you always work with latest technology materials.

Our experts Sabine Brechtl ext. –154 and Tanja Hinkel ext. –132 are pleased to provide more information.

High Performance – CRETA (Corrosive Resistant Target) for SPACELINE II

Starting with June 2004 the SINGULUS TECHNOLOGIES AG introduces CRETA (Corrosive Resistant Target). This new designed silver Target offers up to 550,000 semitransparent DVD9 silver coatings. Stable and consistent layer uniformity is performed throughout the Target life. The patented silver alloy is proven with a variety of commercial bonding resins. With a short data update the CRETA Target can be used on all Singulus production equipment, dedicated for DVD9 silver production.

> For further details please feel free to contact our Target division Sabine Brechtl or Tanja Hinkel.