Media-Tech Association Founded

In a major development in the media manufacturing industry, eight leading technology companies from Europe, the US and Asia have started the MEDIA-TECH Association in Frankfurt, Germany at November 9, 2001.

The founding members include eight leading companies from the media manufacturing industry - EMould (Germany), Convac Technologies (Hong Kong), ODME (The Netherlands), M2-Engineering (Sweden), Comet Automation Systems (USA), Steag Hamatech (Germany), Tapematic (Italy) and Singulus Technologies (Germany).

The goal of the MEDIA-TECH Association (the former „Exhibitor Committee“) is to create a new trade show and conference environment for the media manufacturing industry.

New Exhibition for Data Storage Technology - CD, CD-R, DVD - in Europe!

There has been an overwhelming response to the initial announcement of the new trade exhibition MEDIA-TECH Expo 2002, the International Exhibition on Media Manufacturing Technologies, according to Messe Frankfurt Ausstellungen (MFA) at Wiesbaden.

The Exhibitors group selected Messe Frankfurt due to the convenient location for the European media industry. Messe Frankfurt also provides an excellent venue with exceptional hotel capacity, as well as a great infrastructure. Serving as the largest European air-hub, Frankfurt provides more non-stop flights from international and intra-European destinations than any other European city. This is vital when there will be only one event of this size per year.

For the first exhibition, the organizer is counting on a gross exhibition floor space of around 8500 square metres. In the future, the MEDIA-TECH Expo will be held in Frankfurt and at Las Vegas in alternate years.
Over the last decade CD and now DVD optical discs paved their way into our life, becoming the dominant storage medium for any kind of information. Music, Photographic Images, Videos, Computer Data: all finally are archived on an optical disc. While currently the 650 MB CD is gradually replaced by the 4.7GB DVD generation, the future optical disc successor of the DVD is taking shape.

In a joint press release a group of 9 consumer electronic companies, such as Hitachi, LG Electronics, Matsushita (better known with its brands Technics and Panasonic), Philips, Pioneer, Samsung, Sharp, Sony and Thomson, has announced an agreement on key specifications for a disc with basically the same physical dimensions as CD or DVD, however a 5-fold increase in storage capacity per information layer. These companies expect the market introduction of the required new recording systems not earlier than 2003 or even later.

The tremendous performance improvement will be achieved by reducing the light wavelength of the employed laser diode from 650 nm (red light) to a 405 nm (blue light) and by a reduction of the cover layer thickness from 0.6 mm for the DVD to 0.1 mm for the new generation discs. While in the case of CD and DVD the bare disc is handled, for the new generation disc a standard cartridge housing is expected, as the disc will become more sensitive to surface scratching.

The initial application of the new format will be consumer recording of high definition television (HDTV), which is expected to launch successfully in Japan over the next years. Accordingly the primary research focus at this moment is on a rewritable high density disc. This is a different development strategy compared to CD or DVD, for which first playback only devices and discs with prerecorded information content (CD-Audio, DVD-Video) were launched.

Within this year 2002 the release of a first technical specification is expected and licensing of the technology will start. The very first commercial video recorders are due within a years time. The development of a sizeable market however could easily take 5 years time and requires wide acceptance of HDTV. New professional cameras for video recording need to be employed, the terrestrial satellite or cable based broadcasting will have to be established and a new generation of TV sets is needed at the consumer side.

The press announcement is excellent news, as it shows the commitment of the consumer electronic industry to continue focusing on optical disc as the primary consumer storage medium of today and tomorrow. Accordingly it receives tremendous attention and press coverage. SINGULUS TECHNOLOGIES is fully supporting and participating in the preparation of the new format generation in Japan, where our MODULUS is employed in the dedicated research work at one of the 9 key players facilities.

Of course we will continue to mature our prerecorded DVD technology, as DVD is the ideal optical disc medium for the given data storage requirements, for which we expect strong growth in the coming years.
New Business Sector: TMR Technology: Thin Film Sputtering Systems for the Manufacturing of MRAM Semiconductors and Thin Film Heads for Magnetic Hard Disc Drives

SINGULUS TECHNOLOGIES, the German world market leader for optical disc replication equipment, will augment its business activities with TMR (Tunnel Magnetic Resistance) thin film sputtering systems for IT applications. These are vacuum thin film sputtering systems for use in the semiconductor industry with focus on

- MRAM (Magnetic Random Access Memory) Media
- New TMR-ReadWrite Heads for Hard Disc Drives

Unlike conventional DRAM (Dynamic Random Access Memory) technology, the new non-volatile MRAM storage media will retain stored information even if deprived of power. Additionally, an MRAM chip consumes less energy than a DRAM element. These advantages have led experts to anticipate revolutionary advances in computer technology, particularly for laptops and “smart” wireless devices such as PDAs and UMTS cell phones, etc. The use of MRAM is expected to grow exponentially in years to come, replacing up to 50% of DRAM technology by 2010.

Semiconductor manufacturers around the world such as IBM, Infineon, Motorola, Micron, Samsung and NEC to name a few, are currently working on the development and future commercialization of MRAM technology. All of these represent potential customers for the new 300mm wafer TMR thin film sputtering system which SINGULUS will introduce by year-end. Customer response to initial presentations has been very positive.

Close cooperation with a key customer in the industry will lead to the development of new thin film heads using the same TMR thin film sputtering technology. This second field of endeavor also shows great promise. TMR read/write heads are key elements in the structural design of hard disc drives and well-suited to become catalysts for the next technology breakthrough.

Industrial Application: MRAM - Magnetic Random Access Memory for Laptops and “smart” Wireless devices

Upside Potential: Thin Film Head Technology for Computer Hard Disc Drives
SINGULUS TECHNOLOGIES provides the complete manufacturing solution SUNLINE for all the various rewritable formats, CD-RW, DVD-RW, DVD+RW and DVD-RAM. A thin sputtered active layer composed of a very special alloy material is surrounded by other thin films, which have the function of adjusting the optical or thermal properties of the thin film system. The SUNLINE includes the multi-cathode metallizer MODULUS.

SINGULUS has developed MODULUS, a family of multilayer sputtering machines particularly dedicated to the manufacturing of rewritable phase change discs. In this machine all modern sputtering technologies including pulsed power and RF sputtering are employed. Accordingly today the 13 station MODULUS is the most popular product covering all actual rewritable CD and DVD formats at low cycle time.

Sputter deposition is the most critical production step, however the manufacturing of rewritable optical discs holds several other challenges as well. The moulding of the substrate requires excellent replication, as the stamper structure size is equivalent to the desired pit/groove geometry on the substrate. Furthermore the disc should have an appropriate pre-tilt in order to compensate for different influences from sputtering, lacquering/bonding and initialization. Of course the optical quality of the disc is very important, as blank media can operate under higher speed as DVD video discs. For this purpose we employ the EMOULD machine, as a state of the art fully electric moulding machine with excellent replication, repeatability and economy of operation.

Another issue is proper bonding and curing of the halves. The SUNLINE bonding section accordingly is based on the proven SPACELINE bonding technology. Of course our engineers also took the opportunity to realize a few new ideas collected over the years. Equipped with state of the art inspection tools SUNLINE provides all functions and the performance required to make the replication of rewritable CD and DVD formats a profitable business. The package would be incomplete without the process technology to make these sophisticated discs.

Therefore SINGULUS is working with key format makers as Philips and Pioneer in order to provide also the latest phase change technology to its customers for making high quality media.

During the last few months SINGULUS EMOULD has been facing a remarkable demand for the EMOULD injection moulding machines. In order to cope with this development SINGULUS EMOULD has opened a new manufacturing facility in Würselen/Aachen in Germany. The additional floor space of 2.100 square meters for production of machinery offers the possibility to increase our production output significantly. The new operation has started at beginning of April 2002. While building up this new operation we are taking the chance for further optimization of our concept in logistics.

We are happy to welcome quite a number of new employees in our staff. Not only in the production area but also in the fields of engineering, service and training we were able to recruit some new skilled technicians in order to fulfil the current and upcoming market needs. On this basis SINGULUS EMOULD is ready to provide a good service to the customer - not only by quick installations, but also by excellent after sales support and training.

In this way SINGULUS EMOULD is able to meet the rising demand for EMOULD injection moulding machines now and in future, not only with short delivery times but also with qualified support to our customers in every phase of the relationship.
Based in the small and quiet village of Horb in the south of Germany, just 35 km away from Stuttgart, Mr. Volker Elsässer started his CD and DVD stamper service company.

An interview with the founder and owner of this company, 3 years after the start.

Q: When did you start your company?

"I formally started my company in June 1999, I mean, from that date the factory was operational and I started supplying stampers to the market. We decided to go for a turnkey installation, completely provided by OMP in the Netherlands. Even though I was not a newcomer in the optical disc market, for the technology and involved equipment I surely was. It was therefore important for me to have only one supplier offering all the production equipment, including mastering, electroforming up to stamper finishing, even including test-equipment and the DI and waste water systems. OMP accepted the complete responsibility and I had only one partner to contact in case of any kind of technical question." At that time I started with a mastering system for CD only, and had 3 electroforming cells. But already within 6 months after the start, I had to increase my electroforming capacity with 3 more cells. This year I further expanded with another 3 cells. So I have now 9 cells, enabling a maximum production of about 180 stampers per day."

Q: How would you explain this fast growth of your company?

"Actually, you do not need a degree in Economics to know the answer on this. In the stamper service industry, there are three major conditions for being successful, namely delivery time, quality and price. I agree that this sounds all very obvious, but it means that for instance quality has to be good and stable, guaranteed. The equipment choice plays a deciding role in the final production stability. If this cannot be reached, then also delivery times cannot always be reached and prices cannot be competitive. Therefore a big part of the success is determined by selecting the right mastering and electroforming equipment."

Q: Are you only serving the German market or is export a significant part of your business?

"I would say that still the major part of my stampers is for German clients, but the rest, which is still a considerable part, is exported to other European, North African and Middle-Eastern countries.

But Germany still forms the major part. One of my clients, in particular for DVD, is Singulus in Kahl, close to Frankfurt. For more than a year I am the selected supplier of their stampers, which they use for testing and Final Acceptance Tests of their replication lines at their client’s facilities. In these cases, stamper quality must be beyond any discussion. Otherwise these could never be used for proving the quality of the Singulus replication lines."

Q: Do you originally have a background in the optical disc industry?

"Well, not exactly, but yes, I was involved in the pre-mastering technology and recording studios of optical discs, and that is where I learned about the mastering technology. Since this industry was growing and because I was well connected to the market, I felt that there was a good opportunity to start a stamper service company."

Q: Did you have a mastering system with both CD and DVD capabilities from the start?

"No, as I said I initially started with 1 CD LBR. Meantime the DVD format has come up and, anticipating on this market development, I decided to add an LBR for CD/DVD switchable. This gave me the flexibility to make CD or DVD on this second LBR, so from the very first moment that DVD came I was able to offer the stampers. Within a year after installation of the CD system I placed the order at OMP for another one. This one is now operational since about 2 years. The nice thing is that both LBRs are integrated in the same system, producing independent form each other and simultaneously. Just by adding this one module, I could almost double my CD capacity and at the same time have the DVD capabilities available. For me the choice for a system that can be equipped with both capacities proved to be the best option. I remember that, at that time, only supplier offering this feature. Nowadays other suppliers have followed this system concept."

Q: Do you expect further expansion of your mastering capacity?

"Not at this moment, but it actually depends on how fast the demand for DVD stampers grows. In my present production volume, I still see a slightly higher part of CD stampers, but DVD is gaining terrain steadily. If DVD increases further, I will surely have to invest in expanding mastering capacity for DVD."

Until now I am mainly producing stampers for DVD-5, say 70% of the DVD capacity is used for DVD-5 mastering and 30% is for DVD-9. The number of replicators that have DVD-9 lines is still quite limited, and actually the DVD-9 would give our company a boost for further growth and expansion of the mastering equipment. For each layer of the DVD-9 a stamper is needed, so every DVD-9 title requires 2 stampers.

Another possibility would be to enter the recordable formats, like DVD-R(W). OMP is in the process of developing the mastering equipment for that, and it could be an interesting expansion of my company to move into this area."
The SINGULUS CD-R production system STREAMLINE is now available with a cycle time of <2.7 s! The reliable and cost effective CD-R line of SINGULUS TECHNOLOGIES has thus reached even higher productivity.

A stringent layout, the extremely low power consumption and the precise low volume dye dosing system are the main reasons for the low production costs which our customers appreciate in a competitive market.

The highly efficient disc transport system and the proven SKYLINE finishing module are only two of the multiple benefits that count for high reliability. Typcial dye and solvent dosing volumes are in the order of 0.1ml per disc. Refill of dye solution and solvent as well as many maintenance operations are possible without production stop.

The SMART CATHODE allows to sputter 86,000 discs per target with 55nm thick Silver layers at only +/- 5% ununiformity. The low power consumption (only appr. 80kW incl. climate unit, moulding and PC drying) even leads to less infrastructure investment vs. installations of our competitors.

High reliability, low costs and a high process stability enable state of the art CD-R manufacturing and result in the lowest production costs per disc and thus in low costs of ownership. All hardware and controls of the redesigned STREAMLINE CD-R replication system are ready to be upgraded for DVD-R production.
From a strategic point of view Euro Digital Disc is not only located near to the center of Germany, but also just in front of the gateway to most of the East European countries.

The present holding company bought the assets of a small factory in 1997 and started with 3 replication lines, one Dubuit five color screen printing machine for CD and a staff of ten employees. The product line now includes all possible formats with CD Audio, ROM, 80 mm, business cards, CD recordable 74min., 80min., 99min., black in 120 mm, 80 mm and business cards. Meanwhile the group has an own IT company, a publishing company, a sales office in Frankfurt, a sales office in Poland and a very strong distribution network with many agents all over Europe and the Middle East.

“For the extension we choose SINGULUS as a partner in order to achieve our goals with SKYLINE for CD, SKYLINE Duplex for DVD and STREAMLINE E for CD-R. The machines seem to be as flexible as the SINGULUS staff and are proved to be reliable. This is very important from a service point because our plant is 560 km away from SINGULUS at Kahl/Main”, said Denny Holwerda, President and CEO, Euro Digital Disc.

“We also choose SINGULUS because it manufactures the latest technology with all possible innovations, which offers the opportunity to manufacture the so called niche products. Our latest investment in December 2001 was a DVD recordable line, STREAMLINE Duplex, on which we manufacture the latest technology of DVD-R General 2.0. This is the best example of flexibility, because we are not only able to produce 120 mm and 80 mm DVD-R, but after a mould change also the “normal” CD-R. One machine with three features, in fact even four: if necessary we can also use the machine for CD-ROM and CD-Audio.

After a testing period we reached a high quality output and sell our products into the market under the product name DATATRACK”.

Sentinel NV Invests 4.8 Million Euro in a New Production Plant for CD-RW and DVD+RW Media

Sentinel, which has been one of Europe’s leading manufacturers of data storage media for over 20 years, is investing 4.8 million Euro in a new production plant for CD-RW as well as for DVD+RW media and decided for the new SINGULUS RW-Replication Line SUN LINE E. By this investment Sentinel will become one of the European pioneers in introducing rewritable DVD media.

The speed at which DVD+RW is taking over the market shows clearly that we are looking at the de facto standard. This confirms Sentinel’s previous decision to make phase change a core competency.

In a first phase, planned for May 2002, Sentinel will produce High Speed CD-RW media. When the DVD+RW market really opens up in the fourth quarter, Sentinel will position itself as one of the few DVD+RW media manufacturers in Europe. In this way Sentinel is consolidating its position as the most comprehensive data storage specialist. The combination of the new generation of storage media, its famous quality assurance and comprehensive service provision result in the offering of Sentinel and Euroselect branded products, bulk products and private label services.

Sentinel is convinced that, with the choice of DVD+RW media and therefore phase change technology, the path has been laid for the next generation of optical storage media.
2002 is expected to be the year when recordable and rewritable DVDs take off. This is the format that the market has been waiting for. Yet there are many questions to be answered and many decisions to be made.

This seminar, including presentations by AudioDev, Hitachi, Philips, Plasmon and SINGULUS, aims to provide applicants with unbiased, business-critical information in an intense and rewarding one-day technical seminar.

We cannot say which formats will succeed, but we can point out challenges that manufacturers will be facing in producing recordable and rewritable DVDs. Applicants will achieve the knowledge and understanding necessary to help them make the right decisions for their company.

**AudioDev**

**Plasmon**

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**Program Tuesday, May 7, 2002**

**Hall 8, Room Symmetrie 1/2, Messeg Frankfurt**

9.00 Chairman’s keynote, Tim Frost, Chief Editor, One To One

Morning Session - Recordable Media

9.15 - 9.25 DVD Recordable Format Introduction
AudioDev, Speaker: Mr. Rickard Gudbrand

9.30 - 10.35 Process Technology for DVD-R
Plasmon Data Systems, Speakers: Dr. Jitka Brynjolfsson, Dr. Richard Lione

10.40 - 11.25 Manufacturing Technology for DVD-R
SINGULUS TECHNOLOGIES AG
Speaker: Dr. Peter Wohlhert

11.30 - 12.15 Testing of Recordable and Rewritable Media
AudioDev, Speakers: Mr. Leif Jespersson and Mr. Rickard Gudbrand

Complementary coffee with opportunity for personal discussion

Afternoon Session - Rewritable Media

13.45 - 14.30 The DVD+RW Format
PHILIPS, Speaker: Dr. Derk Jan Adelerhof

14.35 - 15.20 Manufacturing Technology for Rewritable Media
SINGULUS TECHNOLOGIES AG
Speaker: Dr. Hans Ebing

15.25 - 15.55 Initialization of Phase Change Discs
HITACHI, Speaker: Mr. Eji Sahota

Complementary coffee with opportunity for discussion

Don’t miss this opportunity!

We look forward to seeing you on May 7.

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**SINGULUS HIGHLIGHTS**

After successfully testing our SPACELINE under production conditions PANASONIC decided to purchase a considerable number of SPACELINE ES for their DVD capacity increase worldwide.

For a second time this year CINRAM ordered SPACELINE ES for their facilities in Alabama and Canada.

Future Media Productions, CA, increases production capacity by ordering another 6 SPACELINE ES.

Technicolor has placed orders for SPACELINE ES for DVD capacity increase in the USA and for a new facility in Poland.

Orders for several DVD-R lines have been placed by customers in Europe, Taiwan and India.

One SUN LINE with MO DULUS for DVD+RW/DVD-RAM was sold to a customer in Eastern Europe.

O quantum Optical Laboratories, France, after starting up DVD production about one year ago have ordered SPACELINE ES.

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