Business Profile

Molecular Imprints (MII) is the technology leader for high-resolution, low cost-of-ownership (CoO) sub-30nm nanopatterning lithography systems in the hard disk drive (HDD), semiconductor and nanotechnology industries. The company's innovative Jet and Flash™ Imprint Lithography (J-FIL™) technology enables semiconductor, HDD and emerging nanotech manufacturers to meet their challenging resolution and cost requirements over multiple device generations.

With over 125 employees, MII is the largest and most successful organization in the world dedicated solely to imprint lithography. MII provides a comprehensive lithography solution encompassing tools, relevant materials, including high purity resists, and expert process support. Its advanced technology can extend scaling for Moore's Law to below 20nm in the semiconductor industry, and extend the areal density roadmap well beyond 1 terabyte/in^2 for disk media in the HDD market.

J-FIL is built on the semiconductor industry's existing optical lithography infrastructure, and uses commercially available imprint. A drop-in replacement technology, MII's systems are suitable for mix-and-match strategies with 193nm lithography, where their resolution and cost advantages can be concentrated on critical layers. This is particularly valuable in the non-volatile memory (NVM) market now dominated by NAND flash devices, which require the finest resolution at the lowest possible cost.

In addition, the ability to create very small features in very dense patterns makes MII's products ideal for producing next-generation memory systems in the HDD market, where low-cost, high-throughput and double-sided patterning are essential.

J-FIL is also well suited for a host of next-generation applications in such "clean-tech" markets as high-brightness light emitting diodes (LEDs) and solar cells, as well as biotechnology, and other emerging nanotech markets.

Corporate Overview

- Founded: 2001
- Headquarters: Austin, Texas
- Headcount: 125 (approximately)
- Funding Raised: $92M
- Focus: Nanoscale Patterning

Key Markets

Hard Disk Drive

- HDD lithography market estimated at $2 billion
- MII enabling double-sided patterned media production for 1 TB/in^2 and beyond areal density

Semiconductor

- CMOS lithography market estimated at $8 billion
- MII targeting critical layer manufacturing adoption in the sub-30nm regime for NVM applications

Emerging Nanotechnology

- Emerging nanotech markets include high-brightness LED, solar, and biotechnology
- MII positioned to enable future high-volume manufacturing

Management Team

- Mark Melliar-Smith, CEO
- David Gino, COO and CFO
- S.V. Sreenivasan, Founder and CTO
- Ken Rygler, CMO
- Paul Hellebrekers, Senior VP of Engineering and Manufacturing
- Dwayne LaBrake, VP of Applications
- Paul Hofemann, VP of HDD and Emerging Markets Business Development
- Ben Eynon, VP of Semiconductor Business Development
- Doug Resnick, VP of Template Technology

Technology Overview

MII delivers a comprehensive lithography solution that is extendible to below 10nm for the semiconductor, HDD and emerging nanotech markets. Along with leading-edge resolution capabilities, customers also benefit from superior CoO advantages.

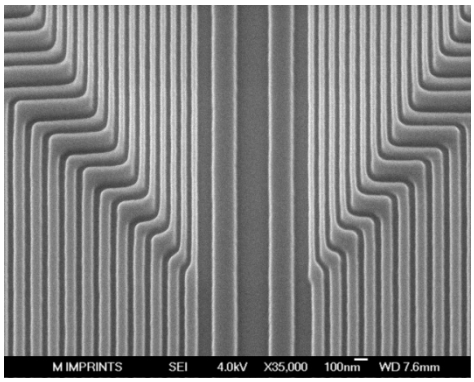
MII's advanced J-FIL process harnesses inkjet technologies that utilize hard disk drive mapping data and the company's proprietary IntelliJet™ Drop Pattern Generation System. A high purity, low viscosity imprint resist is jetted in precise amounts of pico-liter sized droplets according to the features of each unique substrate pattern. Nano alignment technologies are employed as necessary to precisely position and adjust a pre-patterned imprint mask on top of the liquid layer. This enables the precision alignment and overlay required in semiconductor production.

The low-viscosity resist is solidified by blanket UV exposure as part of the low-pressure process. An easy, clean and repeatable mask separation, which leaves the high-fidelity pattern on the substrate, is realized through precise surface chemistry control enabled by MII's proprietary formulations and IntelliJet approach. In HDD and emerging nanotech applications, only a single exposure across the entire substrate is required, while in MII's CMOS systems the process is automatically repeated by field across the substrate.

Precision ink-jetting of the resist according to the unique structure of each device enables simultaneous imprinting of dense and sparse features, while leaving a very thin and precisely controlled residual layer. This enables maintenance of critical dimensions during etch, which enhances device performance and yield. In addition, it eliminates the need for spin-coating equipment and dramatically reduces material usage (>99%). This, in turn, saves expensive clean room floor space by eliminating a coater/track, while virtually eliminating the costly and environmentally unfriendly "spun-off" resist waste disposal problem associated with other imprint lithography approaches for the HDD market.

Technology Advantages

- Extendible beyond 10nm
- Low CoO and capital cost
- Leverages existing lithography infrastructure, including optical photomasks
- Superior CD and linewidth control
- Simplified design with no OPC, PSM or RDR
- Low-pressure, room-temperature process
- Reverse tone capable—minimizes imprint mask write area, increases effective depth of focus and etch selectivity to achieve high aspect ratios



SEM image from Samsung showing J-FIL results for a 38nm half-pitch NVM structure

Investors

- Asset Management Company
- Alloy Ventures
- Brewer Science
- DNP
- Draper Fisher Jurvetson
- Harris & Harris Group
- Hakuto
- Huntington Ventures
- KLA-Tencor
- Lam Research
- luxcapital
- Motorola
- TEL
- WAFRA
- Zeiss

Product Portfolio

Designed to provide semiconductor manufacturers with the opportunity to evaluate and characterize a comprehensive nanopatterning solution for the production of advanced high-density memory storage devices, the Imprio 300 delivers leading resolution, overlay and CoO performance.

Leading NVM manufacturers and industry consortia focused on developing cost-effective sub-32nm half pitch manufacturing processes are utilizing the Imprio 300. By providing lower equipment costs and a simpler lithography process with fewer steps, the system showcases the potential for competitive throughput rates for the lithography cell, faster cycle times and significant CoO advantages at critical layers compared with extreme ultra-violet (EUV), as well as complex and expensive double-patterning schemes. Moreover, it leverages the industry's existing optical lithography infrastructure and is backed by MII's global service and support capabilities.

HDD manufacturers transitioning to the production of patterned media are leveraging the HD2200. The easy-to-use system delivers high throughput, double-sided patterning, extraordinarily low consumable usage, a simple process, low defectivity rates and short cycle times. Unlike wet spin-on UV processes, it does not require the expense floor space of a spin coater or handling of a wet wafer. In addition, the HD2200 saves on material costs versus thermal processes and does not require costly intermediate polymer stamps, which create another environmental disposal challenge. To ensure optimum system results and a smooth transition to patterned media production, MII provides expert lithography process support to its HDD customers.

Product Highlights

Imprio 300

- Ideal for NVM device/process prototyping and pre-production at sub-32nm nodes
- Suited for applications with tight overlay requirements

Perfecta TR1100

- Provides identical copies of e-beam masters at a fraction of original cost
- Based on MII's patented J-FIL imprint technology

Imprio HD2200

- First system capable of development and pilot production of patterned media applications
- Delivers double-sided disk patterning with throughput rates of over 150 disk per hour

Contact Information

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