Software/hardware for e-beam lithography

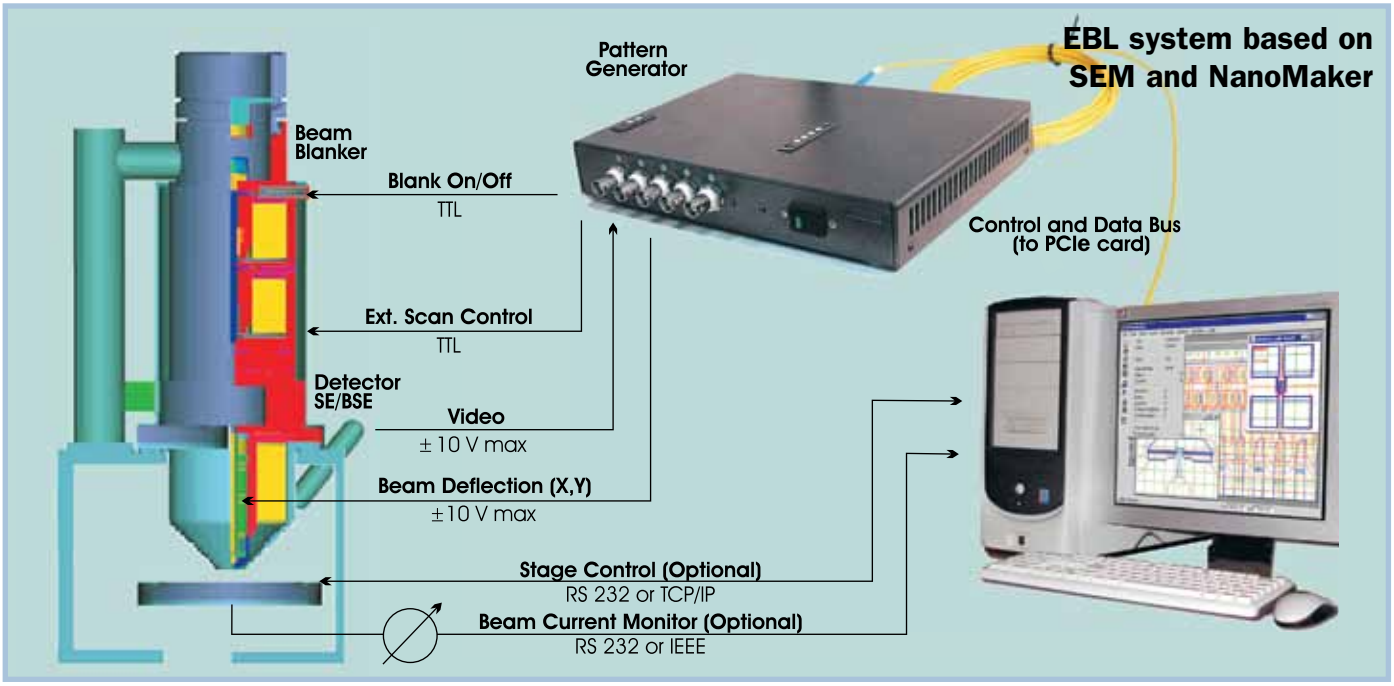
任何扫描电子显微镜（SEM）变换为纳米级制造的电子束光刻系统

System features:

- 高速图形发生器，包括2个16位DAC控制电子束移动位置和一个8位ADC进行图像采集
- PCIe 卡进行电脑控制
- 能和 SEM, EBL,FIB
- 可以对电子束阀进行控制，甚至不用电子束阀。
- 软件基于 (OS Windows™ 2000, XP or 7) 提供 ：
  - 设计 2D/3D 结构
  - 2D/3D 邻近效应修正
  - 模拟刻蚀结果图案
  - 曝光和图像采集过程中补偿畸变

该软件提供了三种基本功能

- 曝光数据准备
  - 内置图形编辑器设计结构
  - 邻近效应修正
  - 曝光和抗蚀造型设计
  - 数据输入输出 (GDSII, DXF, ELM, NME, BMP, TIFF...)
  - 特殊数据处理 (Union, Overlaps Out, Dose Stratification, Negative, Dividing, Frame etc.) 以满足特殊要求
  - 曝光控制
  - 可变曝光时间来进行邻近修正
  - 电子束与移动平台同步
  - «On-the-fly» 补偿动态延误以及失真来提高写入速度



- 视频控制对准以及系统调整
  - 通过一组标记窗口来对齐连续曝光
  - 测量和软件补偿扫描系统误差和移动平台
  - 数字显微镜模式，包括帧的编辑，图像采集，图像处理等。 ，包括全息图

应用领域

- 微电子
- 纳米技术
- 3D 微纳米结构
- 可见光和X射线的衍射光学元件（合成全息图）
- 数字显微镜

Nanomaker system can be delivered both complete and module wise in accordance with the requirements:

– available
– emulation

	NanoMaker Complete deliverable	**NanoMaker Workbench** To prepare data on offline PC	**NanoMaker Writer** To design, perform exposure and image acquisition
Graphics Editor (specialized CAD system)	▬	▬	▬
Import of lithographic structures and images from: *.DXF, *.CSF, *.GDS, TIFF Image Files (*.TIF), Bitmap Image Files (*. BMP)	▬	▬	▬
Export of lithographic structures and images to: *.DXF, *.CSF, *.GDS, *. ELM	▬	▬	▬
Recommended Parameters Reference Table (specialized Database)	▬	▬	▬
Postprocessing (Negative, Union, Frame, Shrink, Erase, Overlaps Out, Dividing, Dose Stratification)	▬	▬	
Proximity Effect Correction (including 3D structures)	▬	▬	
Resist Development Simulation	▬	▬	
Dose Curves using (for 3D structuring)	▬	▬	
Exposure	▬	▬	▬
Image Acquisition and Processing	▬	▬	▬
Stitching and Alignment of Exposure fields	▬	▬	▬
Job Processing	▬	▬	▬
Active Compensation for Distortion and Dynamic delays	▬	▬	▬
User Guide in electronic form	▬	▬	▬
Pattern Generator + Drivers	▬	▬	▬
Stage and Microscope Control Drivers (optional)	▬	▬	▬

Elli30 PCIe Pattern Generator

Elli30 PCIe Pattern Generator

是一种先进的数据采集产品，
高速数字 - 模拟寻址能力
和模拟 - 数字转换采样结合
来提高抗干扰能力。

- 图形发生器解决方案包括
  - 板卡提供数据总线卡槽
  - 模拟控件提供独立电源
  - 2 米光缆
  - 接口电缆
  - 软件适用于OS Windows 2000, XP, 7

  模拟机退耦电路结构，数字板通过光纤电连接到电脑，提供高速防噪数据传输。

- 图形发生器主板包括
  - 2个 16-bit 数字模拟转换器 (50 MHz DACs)
  - 1个 8-bit(ADC) 模拟数字转换器
  - 电子束阀开关
    (TTL output level)
  - 内部/外部扫描模式开关
    (TTL output level)

Output XY DACs and input ADC voltages can be tuned for arbitrary intervals in ±10.0 V range.

Time characteristics of the Pattern Generator

Minimal exposure dwell time	50 ns (20 MHz)
Dwell Time resolution	10 ns (100 MHz)
On-board image accumulation (per accumulation cycle)	50 ns (20 MHz)
Minimal image acquisition time (time of XY DACs addressing + transferring of ADC signal)	0.8 μs (implying 12 accumulation cycles)

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Hi-Tech Solutions from Interface, Ltd.

The ultimate e-beam lithography resolution through innovation

NanoMaker

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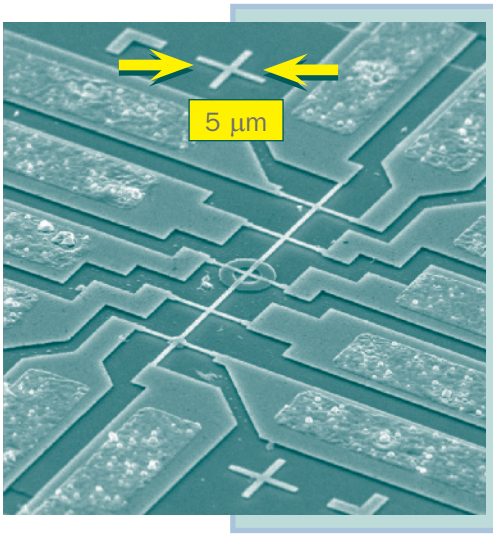
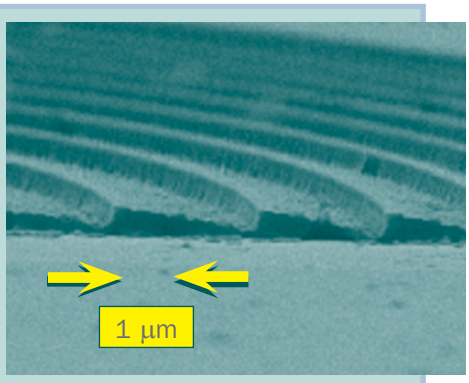


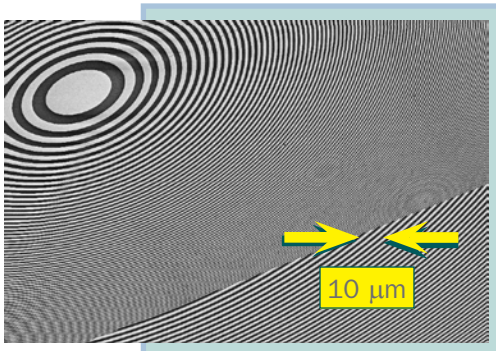
Alignment for successive e-beam lithographies

Contact pads were made by photolithography then e-beam lithography was used to make mesa structure (rings). Another e-beam lithography layer was then incorporated to produce the metal contacts.



3D Proximity Correction and 3D Structuring

Kinoform optical device produced by 3D lithography. By using 3D proximity correction, objects with arbitrary 3D shape can be created during a single exposure.



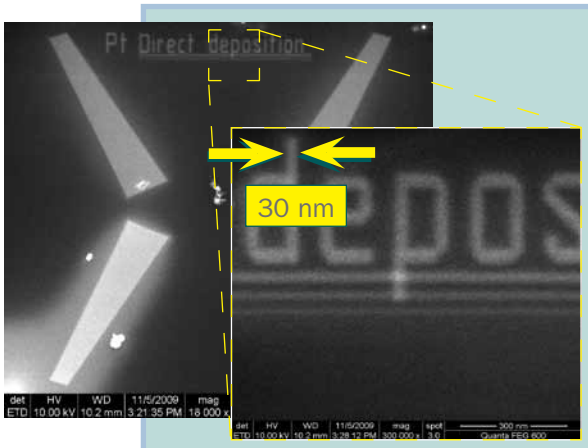
A fragment of device for X-ray optics and spectroscopy (by the courteously of A. Firsov, BESSY II)

Large scale device production in combination with high resolution interferometer stage

NanoMaker's unique features of exposure fields stitching based on dynamic compensation of beam position in combination with an interferometer stage, demonstrate excellent results in production of large-scale devices (up to a few centimeters).

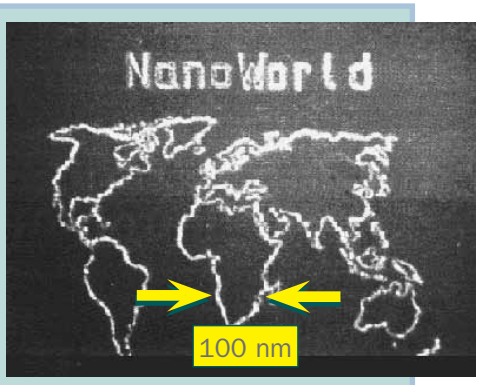
Rainbow holograms (OVD) writing with a SEM

Kinematic rainbow hologram produced at Bessy II using LEO 1560 SEM controlled by NanoMaker (by courtesy of A. Firsov) . 400 nm PMMA resist covered by 50 nm of AL. Sample size is 2 cm by 1 cm



Gas Assisted Focused Electron Beam Induced Deposition

The NanoMaker can be successfully used for controlled deposition of thin film coatings on substrates by decomposing of metal-organic vapors induced by focused electron beam irradiation (so called Gas Assisted EBL). Photo demonstrates deposited thin Pt lines of 10, 20 and 30 nm width. By courtesy of Dr. L. Rotkina, UPenn.



Ultra High Resolution

This smallest world map produced by EBL. It has been produced by Proxy-Writer (the MS DOS predecessor of NanoMaker) in connection with a scanning electron microscope (UHV FE-STEM HB 501). The substrate was a SiN membrane covered with the electron sensitive material AlF3.

INTERFACE

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