Improved Projection Exposure System for Fabricating Nanomaterials

A single step photolithographic projection exposure system based on multi-beam interference lithography (MBIL) for making small devices

Georgia Tech inventors have developed a single step photolithographic projection exposure system based on multi-beam interference lithography (MBIL) for making these smaller devices. The method produces periodic-structure-based nano- and micro-scale elements through a combination of direct imaging and interference between laser beams derived from the same laser. The system can produce high spatial frequency, periodic optical-intensity distributions with incorporated functional elements. This technology enables both rapid prototyping and large-scale manufacturing of photonic crystal devices, metamaterial devices, microfluidic devices, and biomedical structures. Development time is reduced by orders of magnitude, dramatically increasing fabrication speed and decreasing the cost of manufacturing photoelectronic device components.

Summary Bullets

- **High speed processing**: Enables rapid prototyping and large-scale manufacturing
- **Simple optics**: Nano-scale patterning achieved without complex optical systems or photomasks
- **Cost effective**: Replaces slow and expensive electron beam lithography

Solution Advantages

- **High speed processing**: Enables rapid prototyping and large-scale manufacturing
- **Simple optics**: Nano-scale patterning achieved without complex optical systems or photomasks
- **Cost effective**: Replaces slow and expensive electron beam lithography

Potential Commercial Applications

- Dense integrated photonic circuits and systems (DIPCS)
- Biomedical materials
- Nano- and microelectronics, including etching optical/electronic vias
- Optics, including beam splitters, filters, and back-lighting elements

Background and More Information

This technology provides a transformative process for making compact periodic-structure-based electronic devices. Using gridded design rules, semiconductor versions of these devices become integral components in cell phones, flat panel displays, GPS devices, solar cells, flash memory drives, and thousands of other electronic devices. There is a continuing need to decrease the size of components while increasing power and speed. Optical lithography has allowed semiconductors to steadily decrease in size, but there are concerns that conventional optical lithography cannot provide the decreasing sizes that the industry demands. New approaches are needed to create smaller devices.

Inventors

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