



## Focus on Grayscale Lithography *workshop*

At UMN Minnesota Nano Center  
Tuesday May 28 12:00pm – 4:00pm

Grayscale Lithography is becoming an increasingly important feature that is used on Heidelberg Instruments Lithography systems. In this workshop we will give an introduction in the methodology of creating grayscale patterns. This Workshop is divided into a seminar and a practical training session at one of the DWL systems with grayscale capability installed at the UMN Minnesota Nano Center.

We will be serving a box lunch and transportation from The Hyatt Regency Minneapolis (EIPBN 2019 venue) if required.

We are limited to only **10 spots!**

Please rsvp at [nie@himt.us](mailto:nie@himt.us) to reserve a spot. Please note if you need transportation to and from the Hyatt Regency Minneapolis.

### **Agenda:**

- 12:00 Lunch with talks at seminar room at UMN Nano Center
- 12:00 - 12:15 Welcome - Niels Wijnaendts van Resandt
- 12:15 - 12:35 Grayscale Lithography with Heidelberg Instruments DWL Series – Andreas Ludwig
- 12:40 - 12:50 Grayscale with NanoFrazor - Niels Wijnaendts van Resandt
- 13:00 - 15:45 Workshop with the DWL2000 in the cleanroom.
- 16:00 Transportation to EIPBN, Hyatt Regency Minneapolis.

**Abstract:****Grayscale Lithography with Heidelberg Instruments DWL Series**

*By Andreas Ludwig, Heidelberg Instruments.*

Grayscale laser lithography is a versatile technique for the creation of microstructures in photoresist. In contrast to traditional lithography, where the photoresist is either completely exposed or unexposed, grayscale lithography transfers exposure intensity gradients into a resist topography. Its geometric flexibility, high speed and the possibility to scale it up to large exposure areas (e.g. 1.4 x 1.4 m<sup>2</sup>) make grayscale laser lithography a perfect technique for both fast prototyping and large-area production of 2.5-dimensional microstructures for applications like micro-optics, diffractive optical elements, computer-generated holograms, MEMS and many others.

Geometry-dependent proximity effects as well as the non-linear resist response to varying exposure intensities, however, pose major challenges to this technique. Resolving them usually requires time-consuming iterative optimization procedures, leading to steep learning curves for anyone new to the field. To facilitate this, software-based approaches for exposure optimization have been developed, which aim at reducing time and effort required for obtaining the desired geometry.

In this talk, the general concept of grayscale laser lithography is presented with a focus on its implementation on the Heidelberg Instruments DWL series. Several practical aspects concerning exposure optimization strategies are introduced in order to give a preface to the following demonstration in the clean room.