Reticle instrumentation proposal

ASML - Reticle Instrumentation

Background

Whether you are reading this on a computer, on a smart phone, on a tablet, or on any other device, you are using ASML's lithography products right now. In lithography, an image on a reticle is projected onto a wafer to etch the design into the wafer. Figure 1 shows a simplified version of some of the key components in the process. The bottom section shows the round wafer in a square carrier, while the middle section shows the rectangular reticle. The top circular section is part of the optical system.

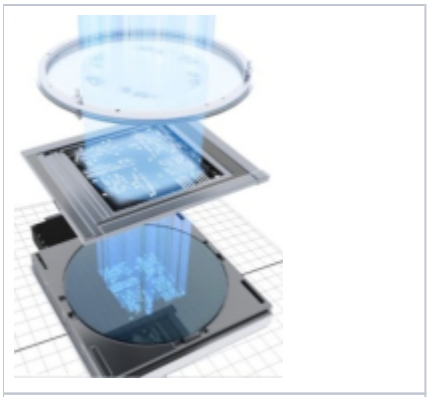

Figure 1 – Simplified Lithography Process

The composition of a reticle varies, though the default is chrome plated mono-crystal quartz or something equally exciting. The wafer is mono-crystal silicon and it is the wafer that gives rise to the microchips that go into electronic devices ranging from fighter jets to mp3 players. Improvement in the lithographic process is so important because as lithography improves, so does the speed and capability of the microchips that are created from the process.

Although lithography makes microchips that are very small, the actual machines that carry out the lithography process are rather large due to the complexity of the process. A lithography system is shown in Figure 2. These machines have been steadily increasing in size, with the current production units about the size of a 16 wheeler trailer.

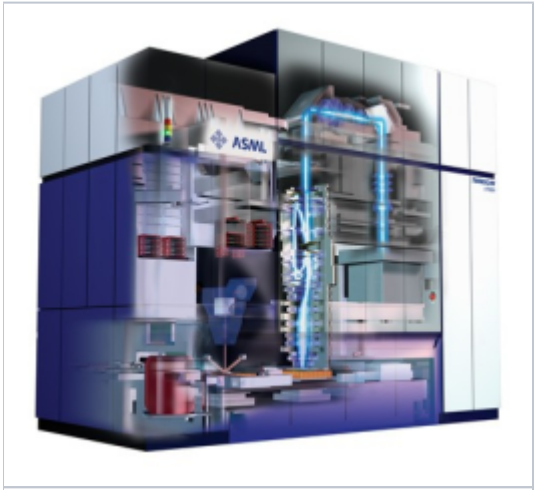

Figure 2: Lithography System

Problem Statement

From the point of view of the reticle, the lithography machine is an endurance test of shock, vibration, temperature, electromagnetic exposure, and other factors. This is where your group comes in. We propose that you instrument a reticle to measure some of the physical quantities such as acceleration, strain, temperature, etc., that a reticle can be subjected to. These sensors can provide a wealth of data to help achieve lithographic goals. Coming up with clever solutions to this problem may very well help improve the next generations of smart phones and laptops.

Requirements

You will need to design a system that adheres to the volume constraints of a reticle

. Shock, vibration, and temperature are of primary importance, but whatever other sensors you can think of that would be relevant to help map the journey of a reticle would be beneficial. Data retrieval needs to be done wirelessly, and the choices of a real time telemetry system or a sensor device with the capability to download data after system exposure will be left up to the students. Note that in some systems, the device will need to survive exposure to strong magnetic fields. Measurement of the EM field would be valuable additional data.

All the electronics and sensors have to be contained within the volume shown by Figure 3. The final configuration needs to have the same dimensions as a standard reticle due to processing constraints. Ideally, the instrumentation could be imbedded into a modified reticle to maintain existing reticle alignment marks used by robotics within lithography machine. Also, to make the instrumentation accurate, the test system weight, stiffness, and center of gravity should be approximately the same as the production system.

_Square section 152 x 152 mm_6.3 mm

Figure 3: Reticle Volume

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