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Synchrotron radiation for advanced electronic chip metrology and manufacturing

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Abstract:

In microelectronic chip fabrication dimensions of features still continue to shrink in spite of the fact that Moore's law has been declared "dead" several times recently. Depending on the product, the "10 nanometer node" is about to be introduced in production. However, it seems that the chip industry now definitively will turn to much shorter wavelengths to be used for photolithography, one of the key technologies in chip fabrication. Extreme ultraviolet (EUV) is presently introduced in pilot production in several fabs, working at a wavelength of 13 nm. But brilliant and stable light sources for this wavelength are complex and expensive.

The paper will review the various R&D opportunities in this field which are offered by the monochromatic, highly brilliant and largely coherent radiation generated by modern synchrotron storage rings. These are:

- EUV interference lithography: This allows to study and optimize newly developed, EUV sensitive photoresists in terms of sensitivity, resolution and line-edge roughness.
- Actinic defect inspection in EUV photomasks.
- Non-destructive X-ray tomographic inspection and quality control of structures inside chips with a resolution down to 15 nm.

Examples will be given in the talk from our recent own research in all three areas. In most cases these results emerge from direct collaborations with world leading chip manufacturers and their suppliers.