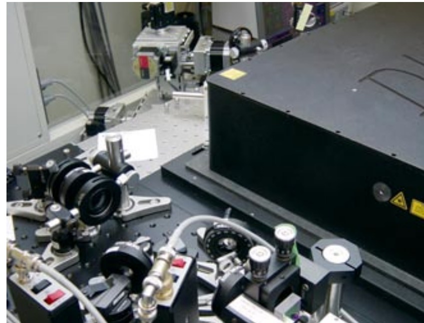
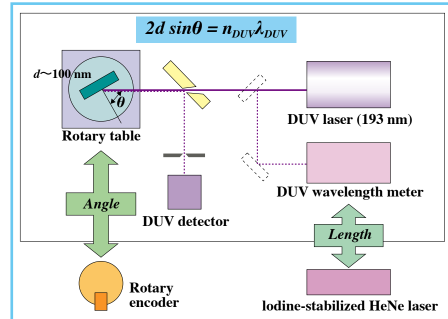
Ultraprecision ruler in nanometer world

An ultraprecision pitch calibration system with a deep ultraviolet (DUV) laser diffractometer for rulers with the pitch of down to 97 nm has been newly constructed in collaboration with Japan Quality Assurance Organization (JQA). A built-in scanning interferometer-based DUV wavelengthmeter and a high-resolution optical diffractometer make every calibration of rulers traceable to the unit of length. Calibrated 100-nm rulers with an expanded uncertainty of 0.04 nm will be used as standards in the inspection of the size of next-generation nanodevices in advanced semiconductor production lines. With the extremely low uncertainty and pitch size comparable with the devices, the rulers will contribute to the improvement of the production yield.



Hardware overview of a pitch calibration system with a deep ultraviolet (DUV) laser diffractometer.



Schematic calibration principle of pitch standards using a DUV optical diffractometry.

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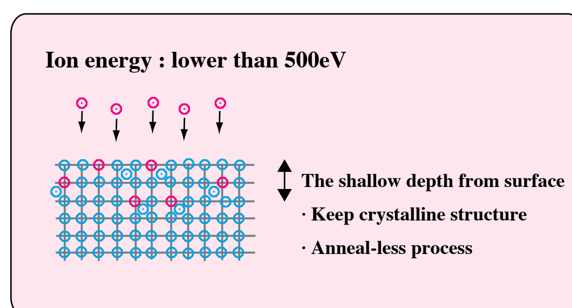
Ultra-low-energy ion implantation to decrease the resistance of silicon

In silicon technology it is thought that an electrically activated, ultra-shallow doping layer will be necessary, and it is predicted to reach 10nm in the year 2014. Ion implantation is a useful method, however, defects are also introduced. High-temperature annealing after ion implantation recovers the crystallization of silicon and activates the implanted dopant. However, it is difficult to keep the ultra-shallow dopant profile because of the diffusion of dopant in Si. In this study, ultra-low-energy ion implantation was examined to reduce the damage during implantation process. The lowest sheet resistance of 2.8 kΩ and the shallow dopant layers below 8 nm were achieved at the ion energy of 300 eV.



Ultra-low-energy ion implantation (● boron, ● silicon)

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