Mo Diffusion

Surface and non-destructive in-depth information

With shrinking structure size in semiconductor industry understanding and control of diffusion processes has become essential. Low Energy Ion Scattering (LEIS) provides detailed information about the diffusion processe on the sub-nanometer scale.
In LEIS analysis the detected ions are scattered at the outmost atomic layer or at layers below the surface.

By measuring the energy of the ions which are scattered at the surface quantitative information about the composition of the top atomic layer can be obtained. By measuring the energy distribution of those ions scattered from atoms below the surface, the elemental composition of sub-surface layers is determined non-destructively.
This static depth profiling provides information down to a depth of 10 nm.

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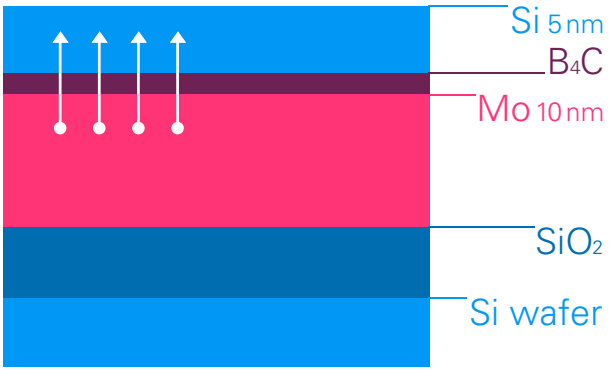
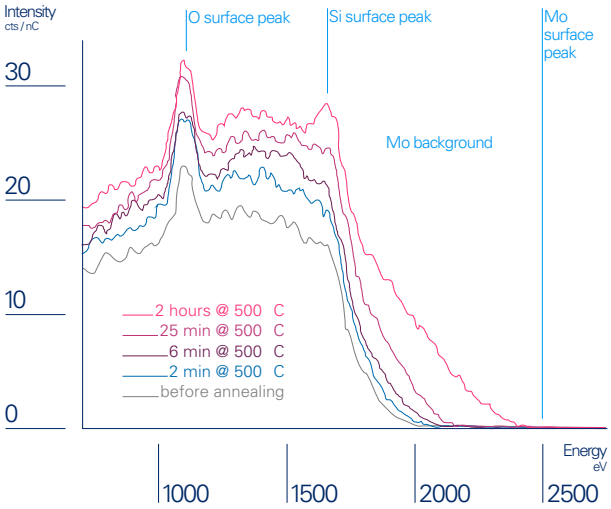
Mo diffusion through a B_4C diffusion barrier

The example below shows the diffusion of Mo through a B_4C diffusion barrier with increasing annealing time. The first spectrum (grey line) shows the Si surface peak and the depth distribution of the Mo. The missing Mo surface peak indicates a closed Si layer on top of the Mo.

After the first annealing step the Mo signal shifts towards higher energies showing the diffusion of Mo towards the surface. With LEIS the diffusion process can be followed closely and quantified on the sub-nanometer level.



Si/Mo layer structure with an ultra thin B_4C diffusion barrier



LEIS spectra taken during in-situ annealing.
Samples and data kindly provided by FOM Institute Rijnhuizen, in the framework of the XMO programme, Andrey Yakshin yakshin@rijnh.nl.
V. I. T. A. de Rooij-Lohmann et al., Appl. Phys. Lett. 94 (2009) 063107