“Advanced mapping characterisation using LEXFAB for Ultra Shallow Junctions fabrication : a key point for sub 45nm devices“

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Abstract. In order to achieve the requirements for doping of source/drain extension for <45nm ITRS nodes, ultra low energy and high dose implantations are needed.

As expected junction depth are lower than 10 nm, all usually used characterisation tool are reaching their limit. This is all the more important than the implantation dose given by the implanter tool is no more a garanty of the final electrical characteristics of the devices. Indeed, pertubating phenomena, ususally negligeable for the S/D doping on 90 and 65 nm devices, are likely to have a great importance on sub 45 nm process. Among them :

- native oxide of 1nm is likely to mask or to consume between 10 to 50% of implanted dose on a 10nm junction.
- Sputtering phenomenum when implanting BF2 at some keV is likely to lead in a boron retained dose of about 50% of the implanted dose.
- Defects after implantation are likely to modify the activation level (Boron desactivation) . The presence and the depth localisation of fluorine or carbone atoms have a great impact on this desactivation level.
- Junction depth and junction abrupness also impact SCE and DIBL characteristics of advanced CMOS
- Beam shapping or scanning modes impact uniformity and reproducibility between several implantation tools.

As the tendency is to reduce the thermal budget of activation processes to avoid diffusion, the implantation characteristics are more and more directly sensitive on the final devices.

To cope with these problems, we have studied the capability of LEXFAB tool to provide, in a mapping way, the key information which ensure quality of the Ultra Shallow Junction (after implantation or after annealing). That is to say : mapping of doping species, depth of doping, native oxide thickness, cross contaminants.

First optained results on Plasma implanted wafers (Using PULSION® tool) having a 10 nm junction depth are presented.