GSD Implanter Application to Mainstream CMOS Processes

John Schuur, Innovion Chief Technical Officer (CTO)
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Innovion Corporation's 150mm and 200mm AXCELIS GSD implanters provide a number of options for advanced production and development processes. The capability to process medium current and high current implants in tools with advanced process cleanliness is a great step forward in offsite implant process capabilities.

An obvious strength of GSD implanters is high current work such as contact doping, polysilicon doping, amorphisation, source/drain or source/drain extension. Shallow boron junction implants stand out as the high current application where there may be a great disparity between internal capabilities and the GSD.

The B11+ thruput available on the GSD is superior to the internal capability of many fab areas. Using the GSD for this type of work can be very cost effective, either as a primary implant source or to preserve a substantial amount of internal capacity.

Industrywide acceptance of the GSD as a broad range implanter brings up a variety of other applications that might be less obvious but are nonetheless attractive. The recipe chaining feature of the GSD allows the disc to be loaded and a series of implants completed before unloading the wafers from the disc. The implanter can retune its beam parameters using the autotuning feature or change wafer orientation between each implant in the series. This method is extremely cost-effective as long as all implants in the list use the same gas source. There are also inherent advantages to recipe chaining, as handling the batch of wafers only once reduces the risk of misprocessing or adding defects.

The ability of the GSD endstation to allow for implants up to +/11 degree implant angles in both the alpha and beta planes provides another option (in addition to Innovion's NV6200 AV implanter) for Lightly Doped Drains (LDDs). This type of application appears to be evolving toward higher doses as the terminology changes to describe them as source/drain extensions. The GSD is a uniquely flexible tool with the beam current capability to provide these implants cost-effectively at both present doses (cross-qualified with the NV6200 AV) and as the doses approach or enter the E15 range. There is a distinct throughput advantage for the GSD over single wafer implanters performing these implants. The differences are greatest when comparing implanters without wafer rotation and smaller wafer sizes (more wafers on the disc). The advantage is substantial even when the doses do not require greater than minimum implant time because of beam current limitation on the single wafer implanters.
Perhaps the most attractive alternative application of the GSD is for "tailored" or "engineered" well or channel implants (or similar applications such as the shallow portions
of an engineered Nwell).

Utilizing a series of three to five implants with varying energies and doses "tailored" or "engineered" to produce a "retrograde" or related structure can produce superior device performance. Engineering

INNOVION CORPORATION
2121 ZANKER ROAD
SAN JOSE, CA 95131

INNOVION CORPORATION
2060 BRIARGATE PKWY, STE. 325
COLORADO SPRINGS, CO 80920

INNOVION CORPORATION
265 BALLARDVALE STREET
WILMINGTON, MA 01887

issues such as special precautions for the use of double charged species must be properly managed. Creatively using any of the technologies above can have important ramifications in a fab area's implant capacity strategy. Depending on the lack of capabilities of any in house machinery, using the GSD can reduce defects or cycle time or both. Performing the multi-step implants inside during a capacity crunch could require up to an equivalent number of implants to be performed outside. Alternatively, performing the LDD implants on a GSD rather than an in house single wafer implanter could free internal capacity for up to four individual implants. Likewise, performing an engineered well using recipe chaining on a GSD can free internal capacity for a similar number of discrete operations previously required by the well.

The scenarios above are especially attractive applications for outsourcing because they eliminate multiple trips to the service center and minimize transit time (and, therefore, cycle time) and costs. Depending on the capabilities of a fab's internal implanters, using the GSD can have substantial advantages for defect reduction, improved process control, and throughput.

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