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First results from emission channeling lattice location experiments of 27Mg in nitride semiconductors

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During the SiC-W RILIS Mg run in September 2009 we managed to do first on-line emission channeling lattice location experiments using 27Mg (9.46 min) implanted into GaN and AlN. The room-temperature as-implanted beta- emission channeling patterns showed that the large majority of ion implanted Mg is incorporated on Ga or Al sites. While the detailed analysis of this experiment by means of fitting the experimental patterns to the results of simulations for 27Mg on different lattice sites remains to be done, simple visual inspection of the experimental data gave no indication for large fractions of Mg on interstitial sites.
The biggest problem to be overcome was the ˜1.5 nA stable 27Al contamination that was present at mass 27 in this type of target (and also in similar UC2 targets). However, the 27Al contamination could be significantly reduced by running the target and line at very low temperatures (estimated target temperature 1000-1200℃). For that purpose the target and line heating currents were decreased to 220 A and 250 A, respectively, which reduced the 27Al current to 2-4 pA, with around 0.3 pA of 27Mg left. In radioactive equilibrium this 27Mg current results in around 1500 Hz count rate in the position-sensitive emission channeling detector, enough to carry out on-line measurements during implantation but not sufficient to perform proper thermal sample annealing (a typical annealing sequence lasts ˜20 min before the measurement can start). In order to deal with this situation better next year, the Si pad detector will be equipped with an aluminated mylar foil window, allowing to operate the detector while the sample is at elevated temperatures and thus allowing to directly measure a higher implantation temperatures.

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