New Detection Limits for AMS with Stable Isotopes ◊

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The development of the ultra clean ion source at the Munich accelerator laboratory was described in former annual reports and in [1–3]. Due to the usage of supra pure silicon for all apertures shielding the target, the detection limit for Fe and Cu in silicon is now 10^{-10}. A new application of the new injector was the detection of nitrogen in diamond.

1. Usage of supra pure silicon

In order to suppress the contamination, caused by the target shieldings, the gold coated stainless steel apertures were replaced by supra pure silicon. The old and new version of the target shielding is shown in fig. 1. The Fe- and Cu-concentration in silicon wafers is measured with the new shieldings and determined to be $\frac{\mathrm{Fe}}{\mathrm{Si}} = 1.9 \cdot 10^{-10}$ and $\frac{\mathrm{Cu}}{\mathrm{Si}} = 6.5 \cdot 10^{-10}$. This means an improvement of four orders of magnitude.

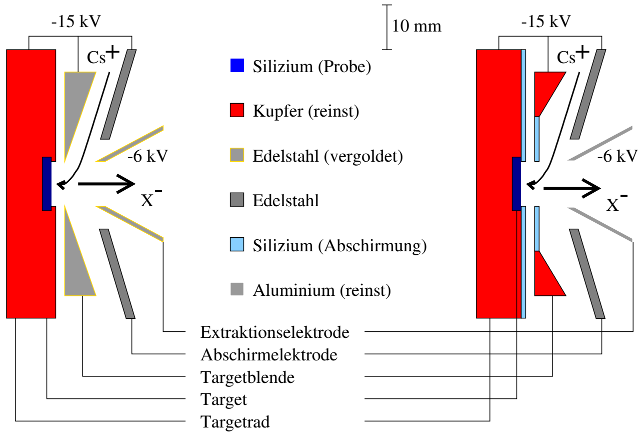

Fig. 1: The stainless steel shielding (left) and the supra pure silicon shielding of the target

2. Detection limits

In order to find out the detection limits of several isotopes in the range between ^{11}B and ^{78}Se, we investigated some supra pure silicon samples. To normalize the negative ion formation relative sensitivity factors are taken from SIMS-measurements [4]. Fig. 2 shows the detection limits in comparison with SIMS detection limits and the limits of the other two groups, which are invesigating stable isotopes with AMS. Up to now the best detection limits for B, Fe, Cu and Se have been achieved at the Munich facility. In allmost all cases the detection limits of AMS are better

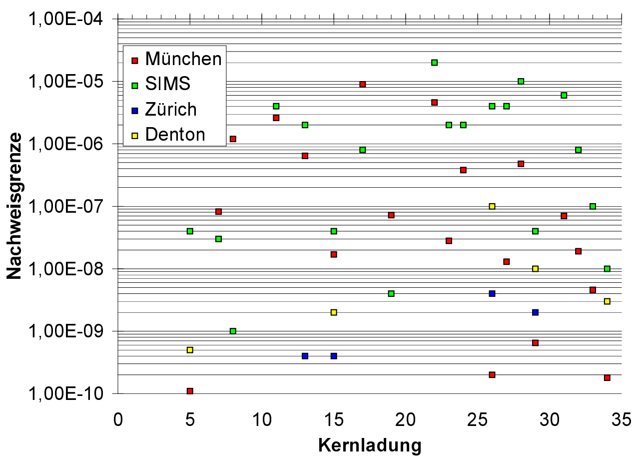

Fig. 2: Detection limits

3. Nitrogen in diamond

Tab. 1 shows the results of the diamond measurement. The values are similar to the detection limit of ERDA measurements. The limit in silicon is at least two orders of magnitude lower than the sample concentrations.

Sample	Matrix	R_N/R_{Matrix}	c_N
AB 1	diamond	$4,1 \cdot 10^{-5}$	41 ppm
AB 3	diamond	$1,0 \cdot 10^{-5}$	10 ppm
AB 4	diamond	$3,4 \cdot 10^{-5}$	34 ppm
AB 5	diamond	$7,7 \cdot 10^{-5}$	77 ppm
N22-7	silicon	$2,1 \cdot 10^{-7}$	82 ppb

Table 1: Nitrogen content in serveral diamond layers

References

[1] C. Faude, diploma thesis, TU München, 1993
[2] S. Massonet *et al.*, Proc. of the 14th Conference on Application of Acceleretors in Research and Industry, Denton, TX, USA, 1996
[3] S. Massonet, Ph.D. thesis, TU München, 1997
[4] R. Wilson *et al.*, *Secondary Ion Mass Spectrometry*, Wiley & Sons, 1989.

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