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Gas Source Development for Accelerator Mass Spectrometry

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Caesium sputtered ion sources when used on solid graphite powdered samples have been thus far - capable of generating a peak negative (^{12}C)-beam current of around 200-400 μA ($\sim 10^{15}$ ions/s). However, when using CO_2 gas directly as the carbon source - less of the sample is lost during the graphitization process, which is of vital importance when one has a limited amount of the material they want to analyze. Middleton (1984) tested a Cs sputtering ion source to form C^- ions directly from CO_2 gas on titanium targets. At which time he produced a 10 μA beam current by using a very low CO_2 flow rate of $<4 \mu\text{L}/\text{min}$. (STP) ($<2 \mu\text{g}/\text{min}$. carbon) that was shown to be the best for high sputtering efficiencies of $\sim 10\%$. Accordingly, the runtime was longer - but more of the carbon ions were measured. In comparison, when using TiH_2 & other solid hydride samples were used to create a negative hydrogen beam (using a similar source as mentioned above), an 80-90 μA peak current was the maximum ever achieved (while 20-30 μA is typical). This report describes the development of novel gas source AMS - to ideally be able to measure tritium ions & other rare isotopes using μg sample sizes.

Primary author: BOLEN, Ryan (University of Ottawa)

Presenter: BOLEN, Ryan (University of Ottawa)

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