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Graphitization of atmospheric CO_2 from whole air samples with the new ALF-NewAge system

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The atmospheric concentration of carbon dioxide (CO_2) has been increasing steadily since industrialization. Emission of ^{14}C-free CO_2 from the combustion of fossil fuels, such as coal, oil or gas, reduces the $^{14}CO_2$ to $^{12}CO_2$ ratio in the atmosphere. When the background $^{14}CO_2$ level is known, the local surplus of fossil CO_2 can be calculated using the measured CO_2 concentration and $^{14}CO_2$ abundance at a given site (e.g. Levin et al. 1989). However, the measurement of atmospheric $^{14}CO_2$ from whole-air samples by AMS requires meticulous sample preparations. That includes the isolation of CO_2 from other atmospheric gases and its subsequent graphitization to form uniform graphite targets for ^{14}C measurements by AMS.

Here, a new fully automated air loading facility (ALF), together with a new dedicated graphitization line (NewAge), is presented. The system allows for the simultaneous graphitization of up to 10 air samples, standard or reference gases that are stored in 3L glass cylinders at typically 1.6 bar (NORMAG Germany). The NewAge graphitization unit is based on the principles of the established AGE graphitization line (Wacker et al. 2010): The isolation of CO_2 from air is performed by a molecular sieve trap, from where it is directly transferred to the reaction tubes by thermal release. This approach omits the use of liquid nitrogen and vacuum lines that are present in similar systems. A significant redesign compared to the original AGE system optimizes the new system for air samples by including a new dedicated air sampling trap, which allows for a high airflow of over 750 ml/min when sampling. Further, the number of reactors has been increased from 7 (AGE) to 10 (NewAge) while at the same time reducing the footprint of the system.

Overall, the NewAge system allows for a high air sample throughput (20 - 30 samples per work day) with minimal user input. First results showing the reproducibility of standards and references as well as the blank level are presented for the system.

References

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Student Submission

No

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