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Measurement of ratios of oxygen isotopes with pNRA at a microprobe beamline.

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Isotopic fractionation of light elements such as carbon, oxygen and nitrogen is a basis of many analytical tools in hydrology, geology, paleobiology and paleogeology. The goal of the current experiment is to investigate if a nuclear microprobe could be utilized for those applications.
Particularly we focus on measurement of oxygen isotopic ratio. The measurement of stable isotopes of oxygen has a number of applications. The one driving the current investigation is astrogeology or specifically evaluation of fossil extraterrestrial material [1].
There are a number of methods within Ion Beam Analysis, IBA that are sensitive to isotopic and not elemental concentrations. The method chosen by us is photon tagged Nuclear Reaction Analysis pNRA, which is a gamma-particle coincidence method developed at Lund Ion Beam Analysis Facility, LIBAF [2].
The pNRA method was used with a 2 MeV deuteron beam; this setup can potentially be used to detect all 3 stable oxygen isotopes. Three samples of aluminum oxide (Al2O3) were irradiated. One with a natural oxygen isotopic fractionation which is 99.8% 16O, 0.2% 18O, 0.04% 17O as well as two enriched samples, one with 70% of 18O and one with 10% of 17O.
Lines belonging to all three isotopes were identified in the particle gamma plots of the enriched samples. The results of the two experimental runs will be presented with a discussion of how well this method can be adapted to geological and astrogeological applications.
[1] B. Schmitz, Chem. Erde.-Geochem. 73, 117 (2013).
[2] M. Borysiuk, P. Kristiansson, L. Ros, N. Abdel, M. Elfman, E.J.C. Nilsson and J. Pallon accepted to NIM 2014.

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