Performance test of a new graphite target production facility in ATOMKI

L. Rinyú1, I. Futó1, Á. Z. Kiss1, M. Molnár1, É. Svingor1, G. Quarta2, L. Calcagnile3
1Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI)
2 CEDAD, Department of Engineering of Innovation, University of Lecce, Italy

Introduction
Radioarbon dating by gas proportional counter system has a long tradition in the Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI). Institute would like to enlarge its ^14C dating possibilities by the installation of the tandetron accelerator facility obtained from Oxford Radiocarbon Accelerator Unit (ORAU) lately.

The graphite target production system was the first step forward the realization of the system in collaboration with CEDAD, University of Lecce.

This work presents the system, covers the details of these experiments and discussion of the results.

Results and discussion
The gravimetric yield of the process did not reach 75 % in either graphitization conditions. The possible causes of small yield might be the iron powder type [5] and the reduction time during the iron powder activation step [3].

After the graphitization process the residual gases were trapped with liquid nitrogen and measured by Finigan Delta^13 ions ratio mass spectrometer. According to McNichol et al. [6] we got a mixture of CO, CO2 and CH4 gases.

Finally we investigated the memory effect in the system. The results indicate that the contamination of the gas handling line and reaction rigs is very low in case of 580 °C furnace temperature.

We got reproducible ^14C results only in the case of using a furnace temperature of 580 °C and applying reduction alone during the activation step. The background tests of the gas handling line and graphite target production system resulted 0.31 ± 0.05 pMC which was close to the sample processing background values at CEDAD [4].

The furnace temperature during graphitization influences the gravimetric yield. Higher temperatures yield higher results. We observed that the oxidation step during the iron powder activation also decreased the gravimetric yield at the furnace temperature.

The ^14C ion current values also show that reproducible and good results can be achieved only by applying 580 °C furnace temperature and without oxidation of the iron powder.

Finally we investigated the memory effect in the system. The results indicate that the contamination of the gas handling line and reaction rigs is very low in case of 580 °C furnace temperature.

The mean value of the VlRI A sample measured by AMS (109.8 ± 0.7 pMC) is consistent with measured by GPC and with the consensus value for this sample (109.1 ± 0.04 pMC) as published in the first report of the VlRI project.

References