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Radioisotope production through accelerators in crystalline targets

The production techniques of radioisotopes for medical purposes is a valuable and important field in nuclear medicine. In particular, the expensive cost of the prime materials for the production via cyclotron obliges the search for new solutions to enhance the production rate with minor upgrades of the current instrumentation. Oriented ordered structure can modify particle trajectories inside a medium leading to a sensible variation of the interaction rate with atomic nuclei. Under specific orientations of the target with respect to the incident beam, the probability of inelastic interaction with nuclei can be enhanced with respect to the standard rate. This effect is called anti-channeling and leads to an increase of the radioisotope production yield. A dedicated set of experimental measurements were carried out at the INFN Legnaro Laboratories with the CN and Tandem accelerators, to investigate nuclear reactions under channeling experiments. In particular, the production of some Arsenic (i.e. ^{72}As, ^{74}As, ^{76}As) radioisotopes starting from a natural single-crystal Germanium target through a (p,n) reaction was monitored via gamma spectroscopy of the prompt γ-rays upon de-excitation of produced nuclei, in order to quantify the production rate variation with the incident angle.

Summary

Topic

1. Crystal Channeling and related mathematical, physical and chemical issues

Primary authors: GERMOGLI, Giacomo (FE); DE SALVADOR, Davide (LNL); Mr BACCI, Luca (Dipartimento di Fisica e Astronomia, Padova, ITALY); BAGLI, Enrico (FE); BANDIERA, LAURA (FE); CAMATTARI, Riccardo (FE); CARTURAN, Sara Maria (LNL); Dr CASOTTI, Davide (INFN Ferrara); EVANGELISTI, Federico (FE); Mr GUIDI, Giacomo (COMECER Group spa); GUIDI, Vincenzo (FE); MAGGIONI, Gianluigi (LNL); Dr MAIOLINO, Tais (INFN Ferrara); MAZZOLARI, Andrea (FE); MENEGAZZO, Roberto (PD); NAPOLI, Daniel Ricardo (LNL); RANIERO, Walter (LNL); ROMAGNONI, Marco (FE); SCIAN, Carlo (LNL); SYTOV, Alexei (Research Institute for Nuclear Problems of Belarusian State University); VALIENTE DOBON, Jose' Javier (LNL); Prof. VINCENZI, Donato (cDipartimento di Fisica e Scienze della Terra, Ferrara, ITALY)

Presenter: GERMOGLI, Giacomo (FE)

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