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Emission channeling with short-lived isotopes (EC-SLI) at CERN's ISOLDE facility

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Emission channeling (EC) relies on implanting single crystals with radioactive probe atoms that decay by the emission of charged particles such as alpha, beta- or beta+⊠ particles or conversion electrons, which, on their way out of the crystal, experience channeling or blocking effects along crystallographic axes and planes. The resulting anisotropic particle emission yield from the crystal depends in a characteristic way on the lattice sites occupied by the emitter atoms and is recorded with the aid of position sensitive detectors. In comparison to conventional lattice location techniques by means of ion beam channeling, e.g. Rutherford Backscattering/Channeling (RBS/C), the main benefits of emission channeling are a roughly four orders of magnitude higher efficiency and the ability to easily study also elements lighter than the host atoms. These facts allow performing detailed lattice location studies with very good statistical accuracy at low fluences of implanted probe atoms, usually as a function of implantation or annealing temperature of the very same sample, which is not feasible by other methods.

In this contribution we will give an overview on the current program for lattice location studies at CERN's ISOLDE on-line isotope separator facility, where the EC-SLI (Emission Channeling with Short-Lived Isotopes) collaboration maintains an on-line setup for this type of experiments. Besides some general features of the technique, recent results will be presented on the lattice location of Mg and Be acceptors in nitride semiconductors using the short-lived probes 27Mg(t1/2=9.45 min) and 11Be(13.8 s), as well as the transition metal probes 56Mn (2.6 h), 59Fe (45 d), 61Co (1.6 h) and 65Ni (2.5 h) in Si and in dilute magnetic semiconductors.

Primary author: Dr WAHL, Ulrich (IST/ITN, Instituto Superior Tecnico, Universidade de Lisboa)

Co-authors: Prof. VANTOMME, Andre (Instituut voor Kern- en Stralingsfysica, KU Leuven, Belgium); Mr COSTA, Angelo (IST/ITN, Instituto Superior Tecnico, Universidade de Lisboa, Portugal); Mr SILVA, Daniel (Departamento de Física, Universidade do Porto, Portugal); Mr BOSNE, Eric (Departamento de Física, Universidade de Aveiro, Portugal); Dr CORREIA, Joao Guilherme (IST/ITN, Instituto Superior Tecnico, Universidade de Lisboa, Portugal); Prof. ARAUJO, Joao Pedro (Departamento de Física, Universidade do Porto, Portugal); Prof. BHARUTH-RAM, Krish (University of KwaZulu Natal, Durban, South Africa); Prof. TEMST, Kristiaan (Instituut voor Kern- en Stralingsfysica, KU Leuven, Belgium); Ms AMORIM, Ligia (Instituut voor Kern- en Stralingsfysica, KU Leuven, Belgium); Dr PEREIRA, Lino (Instituut voor Kern- en Stralingsfysica, KU Leuven, Belgium); Prof. RIBEIRO DA SILVA, Manuel (Centro de Fisica Nuclear da Universidade de Lisboa, Portugal); Dr MIRANDA, Pedro (Departamento de Física, Universidad de Chile, Santiago, Chile); Ms AUGUSTYNS, Valerie (Instituut voor Kern- en Stralingsfysica, KU Leuven, Belgium)

Presenter: Dr WAHL, Ulrich (IST/ITN, Instituto Superior Tecnico, Universidade de Lisboa)

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