Contribution ID: **33** Type: **Submitted**

Lattice location of the transition metals Co and Ni in Si

Wednesday 7 December 2011 14:20 (20 minutes)

We have studied the lattice location of the transition metals 61Co (1.6 h) and 65Ni (2.5 h) in Si single crystals of various doping types by means of on-line Emission Channeling using Short-Lived Isotopes (IS453 EC-SLI). 65Ni was directly obtained by means of Ni RILIS ionization, while for the 61Co experiments we implanted the short-lived precursor isotope 61Mn(4.6 s) which decays via 61Fe (6 min) to 61Co, during the Mn RILIS run. In this case only measurements after a waiting period of 30 min were considered.
The samples were low-doped n-Si (7.3-12 Ohm cm, in the following named i-Si), as well as highly p+ (0.0053 Ohm cm) and n+ (0.0030 Ohm cm) doped Si.
While full quantitative analysis of the measured EC-SLI patterns by means of fitting to the results of manybeam simulations of emitter atoms on various lattice sites has not yet been performed, a qualitative inspection gave the following preliminary results.

Directly after room temperature implantation, the major lattice sites occupied by 61Co and 65Ni were substitutional or near-substitutional sites in all doping types studied.
However, after annealing at 500℃ 65Ni changed to tetrahedral interstitial (T) sites in i-Si and p+-Si, while the majority of 65Ni in n+-Si was found on bond-centered (BC) interstitial sites after the same annealing temperature.
Site changes to interstitial T sites were also observed for 61Co in i-Si and p+-Si, while the case of 61Co in n+-Si is still waiting to be measured at next year's Mn beam time.

The behaviour of Co and Ni in Si shows hence some similarities to Fe in i-Si, where site changes from near-S to T sites were already observed in previous
experiments. However, there are also clear differences. While the site changes S->T in the case of Ni and Co occurred already after annealing at 475-500℃, in the case of Fe in i-Si around 600℃ was required in order to promote the corresponding effect.
Also, while Fe showed considerable resistance against high-temperature annealing, which went along with the occupation of ideal substitutional sites after 900℃ annealing, Co and Ni started to show partial out-diffusion from the samples already for annealing temperatures in the 600-850℃ range.

Primary author: Mr SILVA, Daniel (Universidade do Porto)

Co-authors: Prof. VANTOMME, André (Inst. voor Kern- en Stralingsfysica - KU Leuven); Mr BOSNE, Eric (Universidade do Aveiro); Prof. ESTEVES DE ARAUJO, Joao Pedro (Universidade do Porto Laboratorio de Fisica); Dr MARTINS CORREIA, João Guilherme (Instituto Tecnológico e Nuclear Sacavém); Mrs PINTO DE ALMEIDA AMORIM, Ligia (Inst. voor Kern- en Stralingsfysica - KU Leuven); Mr DA COSTA PEREIRA, Lino Miguel (Inst. voor Kern- en Stralingsfysica - KU Leuven); Prof. CASTRO RIBEIRO DA SILVA, Manuel (Instituto Superior Tecnico IST); Dr DECOSTER, Stefan (Inst. voor Kern- en Stralingsfysica - KU Leuven); Dr WAHL, Ulrich (Instituto Tecnológico e Nuclear Sacavém)

Presenter: Mr SILVA, Daniel (Universidade do Porto)

Session Classification: Solid State and Biophysics II