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Radioactive ion beams at ISOLDE: applications to semiconductor physics

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Progress in semiconductor technology requires a thorough understanding and control of defects responsible for the properties of semiconducting materials, both of intrinsic defects, such as vacancies, self-interstitials, or anti-sites, and of extrinsic defects, such as dopants and impurity atoms. Depending on the material and the structural size used in a device, the electrical and optical properties can be significantly altered by a defect which is present at a concentration as low as 10**12 cm-3.
Radioactive atoms have been used in solid state physics and in material science for many decades. Besides their classical application as tracer for diffusion studies, nuclear techniques such as Mossbauer spectroscopy, perturbed γγ angular correlation (PAC), β-NMR, and emission channelling (EC) have used nuclear properties (via hyperfine interactions or emitted particles) to gain microscopic information on the structural and dynamical properties defects in solids [1]. The availability of many different radioactive isotopes as a clean ion beam at facilities like ISOLDE/CERN [2] has triggered an era involving methods sensitive for the structural, optical and electronic properties of defects in solids, especially in the field of semiconductor physics [3,4].
Like stable isotopes, radioactive isotopes used as dopants influence the electronic and optical properties of semiconductors according to their chemical nature. Experimental and theoretical tools are needed for identifying the properties of defects, the diffusion mechanisms being responsible for the mobility of defects and the strengths of the mutual interactions between dopant atoms and intrinsic as well as extrinsic defects. Spectroscopic techniques like deep level transient spectroscopy (DLTS) and photo-luminescence (PL) gain a new quality by using radioactive isotopes. Due to the radioactive decay the chemical origin of an observed electronic and optical behaviour of a specific defect or dopant can be unambiguously identified.
This contribution will highlight a few examples to illustrate the potential of radioactive isotopes for solving various problems connected to defects in semiconductor physics.
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[1] G. Schatz and A. Weidinger, Nuclear Condensed Matter Physics (Wiley, Chichester, 1995).
[2] http://isolde.cern.ch/
[3] Th. Wichert and M. Deicher, Nuclear Physics A 693, 327 (2001).
[4] M. Deicher, G. Weyer, Th. Wichert, and the ISOLDE Collaboration, Hyperfine Interactions 151/152, 105 (2003).

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