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Manipulation of diffusion profiles in CdTe

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Radiotracer experiments are the most sensitive tool for the study of diffusion phenomena in solids. At ISOLDE/CERN diffusion experiments have been performed using the unique diversity of radiotracers delivered for implantation by ISOLDE.
It has been shown that in CdTe the group I elements Cu, Ag, Au, and Na can exhibit the phenomenon of uphill diffusion, which under suitable conditions results in the formation of symmetric concentration-depth profiles that are strongly peaked about the center of a typically several 100 μm thick crystal [1,2,3]. The phenomenon of uphill diffusion is quantitatively understood and successfully described by a theoretical model [4,5] leading to the conclusion that the dopant profile essentially images the profile of the deviation of stoichiometry generated by the diffusion of Cd-interstitials into the initially Te-rich CdTe crystal.
Uphill diffusion can be observed also at significantly lower sample temperatures down to 450 K, if metal layers are evaporated onto the implanted surface of an initially Te-rich CdTe crystal [6]. The effect is mostly pronounced in case of the Ag dopant and Cu as covering metal layer. We will present first results demonstrating that this effect can be applied to manipulate doping profiles of Ag in CdTe by diffusion resulting in 3-dimensionally structured dopant distributions embedded deeply inside the CdTe crystal.
The range of radiotracers suited for diffusion experiments has been significantly enlarged by setting up an online-diffusion chamber at ISOLDE. This chamber enables the use of isotopes having half-lives of less than 1 h and is equipped for measuring concentration profiles extending on a depth scale of up to 10 μm.
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