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Specific features of depth distribution profiles of implanted cobalt ions in rutile TiO 2

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Abstract

This paper reports on the results of the calculation of the depth distribution profiles of the concentration of the impurity implanted into an anisotropic crystalline material. The sputtering of the irradiated material, fast one-dimensional diffusion of the impurity along structural channels, and accumulation of the implanted impurity at different depths have been taken into account. The results of the calculations have been compared with the experimental distribution profiles of cobalt ions implanted into the crystal structure of rutile TiO 2 along and across structural channels at different temperatures of the irradiated substrate. A comparison of the model and experimental profiles has made it possible to evaluate the precipitation rate of cobalt in the TiO 2 matrix on different precipitation centers. A model has been proposed for explaining the unusual shift in the peak of the concentration distribution of implanted ions deep into the sample with an increase in the temperature of the irradiated substrate. The model has allowed one to separate the contributions from different phases of the impurity (nanoparticles and solid solution) to the magnetism of the Co: TiO 2 system. © 2011 Pleiades Publishing, Ltd.

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