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Modelling the oxygen diffusion profile in St 707 non evaporable getter material

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Non-evaporable getter (NEG) materials have become an integral part of many ultrahigh vacuum environments mainly due to their unique surface properties which are able to achieving extreme-high vacuum conditions of the order of 10^{-12} mbar and lower. NEG materials have to be "activated" after exposure to atmospheric gases. Activation is performed by heating the getter to appropriate temperature in order to remove the adsorbed gas molecules/ atoms (mainly oxygen and carbon) from the getter surface to get atomically clean metal surface of getter alloy. Main mechanism of removal of oxygen and carbon is diffusion from the surface layer into the bulk. The elements in getter alloy shall have high diffusivity and high solubility for oxygen and carbon. Diffusion of oxygen gas has been studied for pure metals, but for getter alloys there is almost no data available. At low temperature the diffusion length may be only of the order of few nm so we used surface sensitive analytical techniques such as Auger electron spectroscopy and X-ray photoelectron spectroscopy to investigate activation procedures and depth distribution of elements at various temperatures. Through this method the activation energy and diffusion coefficients are determined for two phases present in the St 707 non evaporable getter material. In the St 707 are present two phases, pure zirconium and Laves phase. Knowing the diffusion coefficients we constructed the true depth profile of Oxygen in St 707. In terms of applications, this model can helps to select appropriate conditions (temperature and time) on the occasion of their use.