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Stress-induced Diffusion of Nitrogen in Nitrided Stainless Steel
ARVAIDAS GALDIKAS, TERESA MOSKALIOVIENE, Kaunas University of Technology — The nitrogen transport mechanism in plasma nitrided an austenitic stainless steel at moderate temperatures is explained by stress induced diffusion (non-Fickian type) model. The model involves diffusion of nitrogen induced by internal stresses created during nitriding process. For mathematical description of stress gradient induced diffusion process the equation of barodiffusion is used which involves concentration dependant barodiffusion coefficient. For calculation of stress gradient it is assumed that stress depth profile linearly relates with nitrogen concentration depth profile (from experimental observations [1]). Calculated nitrogen depth profiles are in good agreement with experimental nitrogen profiles. The diffusion coefficient D=$1.68 \cdot 10^{-12}$ cm^2/s for nitrogen in plasma source ion nitrided 1Cr18Ni9Ti (18-8 type) austenitic stainless steel at 380°C was found from fitting of experimental data [2]. The dependencies of nitrogen ion current density and nitriding time on nitrogen concentration, nitrogen surface concentration and penetration depth are analyzed by proposed model.

[1] T. Christiansen, M. A. J. Somers, Mat. Sci. Eng. A, 424 (2006) 181.
[2] M. K. Lei, X. M. Zhu, Surf. Coat. Technol., 193 (2005) 22.

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