Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Revisiting reaction-diffusion model of thermal desorption spectroscopy experiments on hydrogen retention in material for fusion applications JEROME GUTERL, ROMAN SMIRNOV, SERGEI KRASHENINNIKOV, UCSD — Plasma-material interactions may strongly influence plasma performance and life-time of future magnetic fusion devices. Understanding the multifaceted physics of hydrogen retention in plasma-facing components (PFC) is thus crucial, but remains challenging due to the wide spectrum of retention processes on PFC surface and in PFC bulk induced by long-time exposure of PFC to high flux of energy and particles [1]. We revisit here some aspects of reaction-diffusion models used to investigate hydrogen retention in material. We focus on analysis of thermal desorption spectroscopy (TDS) experiment considering only one type of traps in material and first neglecting surface effects. We show that solute hydrogen concentration in retention region usually remains in equilibrium during TDS experiments. In this regime, analytic description of thermal desorption spectra indicates that trapping of solute hydrogen during TDS cannot be ignored. Main features of thermal desorption are then analytically described and refined interpretation of Arrhenius plots is proposed. Effects of surface processes on hydrogen outgassing during TDS experiments are then introduced and surface-limited outgassing regimes are discussed.

[1] J. Roth and K. Schmid, Phys. Scr., 014031 (2011)

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Date submitted: 25 Jul 2015 Electronic form version 1.4