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Alpha-gamma mode transition in a hydrogen radio-frequency discharge SERGEY ABOLMASOV, PERE ROCA I CABARROCAS, LPICM, Ecole Polytechnique — Hydrogen rich radio-frequency (rf) driven discharges are used for deposition of microcrystalline silicon layers in thin film solar cells. The main issue for industrial application of microcrystalline silicon based solar cells is the relatively low growth rate of the microcrystalline silicon layer combined with relatively large thickness. In rf reactors the deposition rate is known to be an approximately linear function of the rf power density and is limited by the appearance of so-called alpha-to-gamma mode transition [1, 2]. In this study, the alpha-gamma transition in a hydrogen rf discharge has been measured in the pd range of 5-30 Torr cm. The discharge voltage, current and phase shift between them have been detected. A special design of the discharge system allowed visual detection of the discharge area, so that the average discharge current density could be determined. It is found that the current density (as well as the power density) in the alpha mode at 13.56 MHz grows slowly with pd-factor reaching a value of 12 mA/cm2 (about 3 W/cm2) at pd = 30 Torr cm prior the onset of the gamma mode. These parameters are about five-six times higher than those used in modern rf reactors [2] showing that there is still room for optimization of reactors driven at 13.56 MHz. References [1] A. Matsuda: J. Non-Cryst. Solids 338-340 (2004) 1-12. [2] A.H.M. Smets, T. Matsui, and M. Kondo: J. Appl. Phys. 104 (2008) 034508.

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