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液体原料を用いた蒸着法による常圧での a-Si:H 膜の作製（メカニズム）

Formation of a-Si:H Films by Liquid-source Vapor Deposition under Atmospheric Pressure (Formation Mechanism)

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The process to form amorphous silicon (a-Si:H) films has been mainly conducted by using SiH_4 as gas source in a plasma-enhanced chemical vapor deposition (PECVD) system, where the costly instrument and vacuum process are needed. For the requirement of the low-carbon technique all over the world, the principle of fabricating a-Si:H by using liquid silicon has sparked intensive research from the viewpoint of reducing material and processing costs.[1]

Herein we report a liquid-source vapor deposition (LVD), a kind of thermal CVD, to prepare a-Si:H films by using liquid silicon source under atmospheric pressure (*Fig. a, b*) around 400 ºC. Typically, cyclopentasilane (CPS) was used as a silicon source, which was vaporized in a sealed chamber when increasing the temperature of hot plate 2 (*Fig. c-1*). When CPS gas reaches to the top hot substrate (~400 ºC), it is decomposed into a-Si:H and hydrogen gas although parts of SiH_x fragment escape from the surface (*Fig. c-2*). Because of the sealed chamber, the SiH_x fragment redeposits (*Fig. c-3*), resulting in a high conversion rate around 25%. By using LVD system, the a-Si:H films with a high density of 2.2 g/cm^3 and a high photoconductivity of 4.8×10^{-5} S/cm were formed. Those qualities are close or equal to a-Si:H films formed by PECVD.

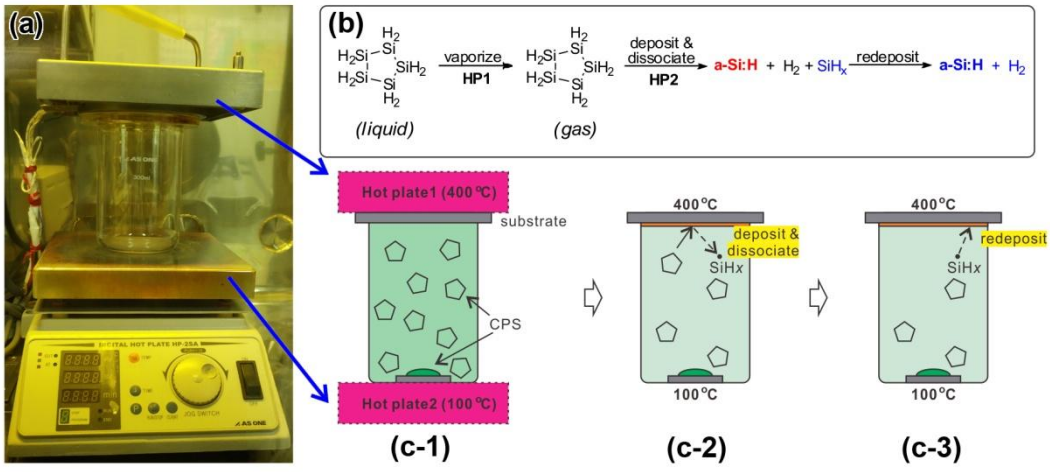

Figure (a) The image of LVD system; ***(b)*** the formula of decomposition of CPS and the formation of a-Si:H; ***(c)*** the procedure of the vaporization *(c-1)*, deposition and dissociation of CPS *(c-2)* and the redeposition of SiH_x *(c-3)*.

【参考文献】

[1] T. Shimoda, Y. Matsuki, M. Furusawa, T. Aoki, I. Yudasaka, H. Tanaka, H. Iwasawa, D. Wang, M. Miyasaka, Y. Takeuchi, *Nature* **2006**, *440*, 783.