

Title	触媒CVD法によるシリコン膜の低温結晶化に関する研究
Author(s)	部家, 彰
Citation	
Issue Date	2000-03
Type	Thesis or Dissertation
Text version	none
URL	http://hdl.handle.net/10119/2080
Rights	
Description	Supervisor:松村 英樹, 材料科学研究科, 博士

Study on low-temperature crystallization of Si film in catalytic CVD method

Akira Heya

JAIST (Japan Advanced Institute of Science and Technology)
School of Materials Science, Matsumura Laboratory

March, 1, 2000

The liquid crystal display (LCD) is expected as a display of next generation because of its high resolution, low energy consumption, thin and light weight. Recently, the higher resolution and lower cost are strongly required. In LCD, each picture elements are switched by thin film transistors (TFTs) made of amorphous silicon (a-Si). However, TFT using polycrystalline silicon (poly-Si) is now extensively studied as an alternative of a-Si because of high carrier mobility. The requirements to poly-Si film for this purpose are listed as; 1) low temperature process ($< 400\text{ }^{\circ}\text{C}$), 2) high mobility ($\geq 10\text{ cm}^2/\text{Vs}$) and 3) high deposition rate ($\geq 0.4\text{ nm/s}$).

The catalytic chemical vapor deposition (Cat-CVD) method was developed at 1985 and poly-Si films were obtained at temperatures lower than $400\text{ }^{\circ}\text{C}$ using a SiH_4 and H_2 gas mixture at 1991.

This work is intended to use such Cat-CVD poly-Si films as new promising materials for TFT. The mechanism of low-temperature crystallization in Cat-CVD method is investigated by studying the role of atomic hydrogen. The relationship among chemical reactions for film formation, crystal structure and mobility is also investigated in order to obtain TFT-quality poly-Si films.

The following conclusions are obtained.

- 1) The roles of atomic hydrogen are important for selective etching and crystallization of a-Si phase. The etching and crystallization by atomic hydrogen depend on structural properties of initial a-Si films even if the structure of the a-Si films appear similar from X-ray diffraction and Raman spectroscopy.
- 2) The poly-Si films with high deposition rate (1.1 nm/s) and high mobility ($10\text{ cm}^2/\text{Vs}$) can be obtained at temperature lower than $400\text{ }^{\circ}\text{C}$. Thus, there is large possibility to be used in TFT fabrication.