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Analysis of Poly-Si Films Crystallized by Laser Annealing and Thin Film Transistor Characteristics

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Low temperature poly-Si (LTPS) TFTs have been widely studied for active matrix displays with integrated circuits, such as AMLCD and AMOLEDs. [1, 2] The higher carrier mobility is required for the full integration of both the drive circuits and the pixel TFTs in a monolithic CMOS technology and can be obtained using the excimer laser crystallization for the formation of the poly-Si films.

Poly-Si films are studied by using amorphous Si thin films with different deposition method, LPCVD and PECVD, for excimer laser crystallization. The poly-Si film which is made from PECVD deposited amorphous Si shows many defects which are due to the hydrogen.

The grain size and uniformity are observed with excimer laser energy. The maximum grain size can be obtained above the 430 mJ/cm^2 but the excellent uniformity can be obtained below 420 mJ/cm^2. The topology of the poly-Si film is made of the ridge and hillock observed by AFM. The ridge happens at the collision region of two grains and the hillock at the collision point of four grains.

The raman signal is analyzed as the laser energy. The amorphous peak is completely disappeared by single excimer laser shot. The poly-Si peak position is insensitive with the laser energy and is red-shifted by 4 cm^{-1} compared to the bulk peak position. The red-shift occurs by the film stress and is changed by the film thickness.

The TFT shows the large swing and low saturation current due to the small grain size. The characteristic kink effect with channel length modulation is also observed with vanishing at 10um channel length.

[참고문헌]

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2. S. D. Brotherton et al., "Laser crystallized poly-Si TFTs for AMLCDs" Thin Solid Films 337, 188 (1999).