

Change of Raman Scattering as a Function of Laser Power in Si-Films Crystallized by CLC

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The use of low temperature polycrystalline Silicon (LTPS) thin film transistors (TFTs) in display devices as the switching component proved to enhance the display performances compared to the conventional amorphous Silicon (a-Si) TFTs, owing to its high carrier mobility in the channel region^{[1][2]}. Grain-boundary free (100)-oriented Si films were crystallized from a-Si by means of green Continuous Wave Laser Lateral Crystallization (CLC) process^[1]. This paper discusses Raman scattering

A-Si with 60 nm thickness were deposited on quartz substrate by PECVD process and later capped by SiO₂ layer with thickness of 160 nm. The sample then underwent dehydrogenation annealing under N₂ ambient at 550°C prior to the laser scanning process with green laser at wavelength of 532 nm. The scanning speed was 15 mm/s with the top-flat beam profile having dimension of 490 × 8 μm². Laser scans were irradiated on the sample using different laser power ranging from 2.0 W to 3.3 W at different positions. EBSD and Raman Spectroscopy were used to study the crystal orientation and the stress induced by the laser power respectively.

Highly (100) oriented Si film was successfully crystallized at 2.1 W. The amount of Surface (100) texture decreases monotonically with the power. But the Raman shift changes with the power, as shown in Figure 1.

Power dependence of Raman will be discussed in conjunction with the change of surface textures and the amount of (100) orientation.

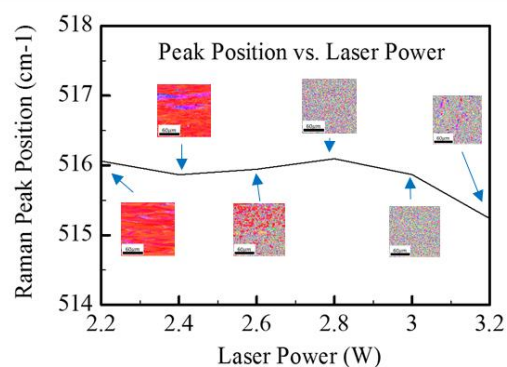


Figure 1. Raman peak position vs. laser power of the poly-Si. The insets show Inverse Pole Figure maps obtained by EBSD.

[1] N. Sasaki et al., Thin Solid Films, 631, 112 (2017).

[2] Chou C. H. et al., Applied Physics Letters, 103, 053515 (2013).