MASTER'S THESIS

Photoluminescence excitation of porous silicon

Ngan, Mei Lun

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Photoluminescence Excitation of Porous Silicon

NGAN Mei Lun

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ABSTRACT

Recent research into low dimensional silicon such as porous silicon has shown that it is possible to produce Si-based opto-electronic devices because of quantum confinement effect. Quantum confinement effect causes Si to widen the energy band gap. The band gap becomes pseudo-direct and therefore the luminescence is more efficient. We used two methods to fabricate Si nano-structure. One is anodisation in hydrofluoric acid and the other is photolithography technique to produce regular pattern on silicon. Photoluminescence excitation experiment in difference temperature was performed on porous silicon prepared from n and p type Si(100) by anodisation. It is found that there are multiple peaks in the spectra at some excitation energy. The photoluminescence peak is blue shifted when increasing the excitation energy. And also, the normalised integral photoluminescence intensity as a function of the excitation energy has a maximum around the excitation energy 3.15eV. We used the electronic structure and wave functions of the quantum wire model and the empirical pseudopotential homojuntion model to compare with the experiment results. We also obtained the relationship between the integrated photoluminescence intensity and temperature which is caused by quenching of PL from two energy levels.

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A Comparison Between An Ex-ante and Ex-post Test of Early Unwinding Strategy in Put-call-futures Arbitrage

PANG Wai Sun

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Abstract

Previous studies on arbitrage efficiency in derivatives market mainly focus on the cost-of-carry relationship and put-call parity condition. Tucker (1993) introduces the put-call-futures parity condition to investigate the joint efficiency of futures and options markets without incurring the trading of equity. The study applies this parity condition since it provides a superior method to investigate the arbitrage opportunity between futures and options markets. Moreover, it overcomes the obstacles which are associated with the trading in the cash leg of the arbitrage portfolio.

In the study, potential investors are divided into four categories by transaction cost paid. Results show that all investors can make positive profit under the buy-and-hold strategy with ex-post data. However, when ex-ante data is employed, only investors in Category C and D, who are the Exchange members, earn positive profit. The result reconfirms Fung, Cheng & Chan's finding (1997) that the long-futures strategy is more profitable than the short-futures strategy. The results also show that the Exchange members (Category C and D) may make profitable trade under longer execution time lag. Regression results indicate that the parity relationship does hold at both the expiration and non-expiration dates.

Early unwinding strategy is adopted with and without execution time delay to test the arbitrage efficiency of the derivatives markets. Under the early unwinding strategy with ex-post data, it shows that the arbitrage profit is improved for all

investors. When ex-ante data is used, the number of observation is reduced sharply for all kinds of investors. We find that the average arbitrage profits for investors A and B (the individual investor and institutional investor) are below zero or insignificant. We also find that the average profits for investors C and D are lower than that in ex-post analysis. This phenomenon may due to the poor trading signal.

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