利用摻鐿光纖雷射與放大器產生高能量似噪音脈衝及其應用之研究

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中文摘要

在摻鐿光纖雷射中所產生的似噪音脈衝包含了寬大且平滑的輸出光譜以及皮秒和飛秒的雙尺度脈衝寬度等輸出特性，這些獨特的特性使其受到許多研究團隊的注意，當使用光纖雷射放大器提昇其輸出功率時，此雷射可以被應用在雷射加工中。在本論文中我們架設了一摻鐿映射色散光纖雷射並透過非線性極化演化的機制來產生似噪音脈衝，此雷射系統能夠產生出重複率為 13.2MHz 的似噪音脈衝輸出，輸出功率可達 0.55 瓦以及雙尺度的脈衝寬度分別是 9 皮秒以及 140 飛秒，並透過兩級光纖放大器，雷射輸出功率可以提昇至 46.8 瓦，對應之單脈衝能量為 3.54 微焦耳，此雷射可被應用在不同材料的加工特性研究中，初步的研究結果顯示當雷射輸出功率為 13 瓦時，可以在不鏽鋼以及鋁合金的表面上產生消蝕效果。

Generation of high energy noise-like pulse from a Yb-doped fiber laser system and its applications

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Abstract

Noise-like pulses generated in Yb-doped fiber laser have attract more and more attention due to their unique features of broad and smooth optical spectrum and double-scale fs/ps pulse duration. It will be suitable for laser machining application when the energy is further boosted up by fiber amplifier. In this thesis, a dispersion-mapped Yb-doped fiber laser is built up to generated the noise-like pulse by using nonlinear polarization evolution mechanism. This laser can generate the noise-like pulse with output power up to 0.55W and double scale pulse durations of 9ps and 140fs at a repetition rate of 13.2MHz. By using two stage fiber amplifiers, the laser output power can be scale up to 46.8W, corresponding to single pulse energy of 3.54μJ. This laser has been used to study the ablation characteristic for different materials. Preliminary result shows that the ablation effect can be observed on stainless steel and aluminum surface when output power is 13W.