

論文の内容の要旨
Abstract of Dissertation

Title of dissertation: Research on mode-locked lasers using single-wall carbon nanotubes
(論文題目: 単層カーボンナノチューブを用いたモード同期レーザに関する研究)

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(本文)(Abstract)

The growing applications in science and industry created increasing demand for stable, robust, compact and affordable ultrashort-pulse sources. Saturable absorbers have been crucial in the development of these passively mode locked lasers. Therefore, the engineering of new saturable materials with superior performance, flexible design parameters and potential for mass manufacture could have considerable impact in making these pulse sources suitable for real-world applications. We investigate the application of a class of novel saturable absorbers, the single wall carbon nanotubes (SWNT) for passive mode-locking. We characterized the spectral and temporal characteristics of bundled SWNT fabricated using various processes and integrated with different structures. In particular, the absolute saturable absorption of these SWNT based devices is characterized and their characteristic parameters are associated with established mode locking theories. This enables the development of guidelines for the design and engineering of these new saturable absorbers for the mode locking of lasers. The performance and limits of these devices are further explored by their application in solid-state Er:Yb:glass lasers and extended cavity fiber lasers. Analyses of the performance of these very different mode locked lasers in relation to the saturation parameters of the SWNT based devices allow the identification of merits and potential limitations of these saturable absorbers in the mode locking of lasers. In addition, the main differences between such devices and conventional semiconductor saturable absorbers are compared in view of possible future improvements and potential new applications.