An amplification of 1550 nm distributed feedback (DFB) laser using 980 nm optical injection

Faten A. Chaqmaqchee

Department of Physics, Faculty of Science and Health, Koya University

JOURNAL OF OPTOELECTRONICS AND ADVANCED MATERIALS Vol. 21, No. 3-4, March – April 2019, p. 180 - 184

An amplification of 1550 nm distributed feedback (DFB) laser using 980 nm optical injection

FATEN ADEL ISMAEL CHAQMAQCHEE
Department of Physics, Faculty of Science and Health, Koya University, University Park, Danielle Mitterrand Boulevard, Koya KOY45, Kurdistan Region-F.R. Iraq

Distributed feedback (DFB) lasers currently offer steady single mode emission for a wide wavelength range of applications. 980 nm was used as pump source into a commercially available distributed feedback DFB operating in the 1550 nm wavelength range. The device were characterized experimentally through light output-current-voltage I-V-L measurements and emission spectra at fixed and at various threshold currents and temperatures. In addition, amplification of the device was detected using pump laser at threshold current of I_{th}=22 mA and room temperature of T=25 ^{o}C.

(Received August 17, 2018; accepted April 8, 2019)

Keywords: Optical injection, Distributed-feedback (DFB) lasers, Input power, Amplification, Temperatures

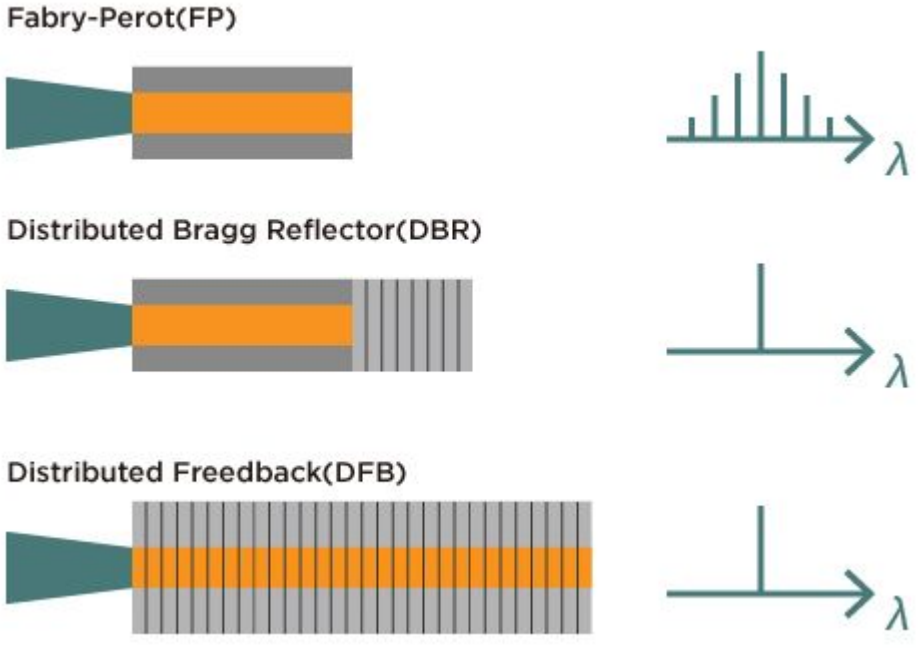
outline

- Introduction
- What is a DFB Laser?
- Experimental Details
- Results and Dissection
- Conclusions

Introduction

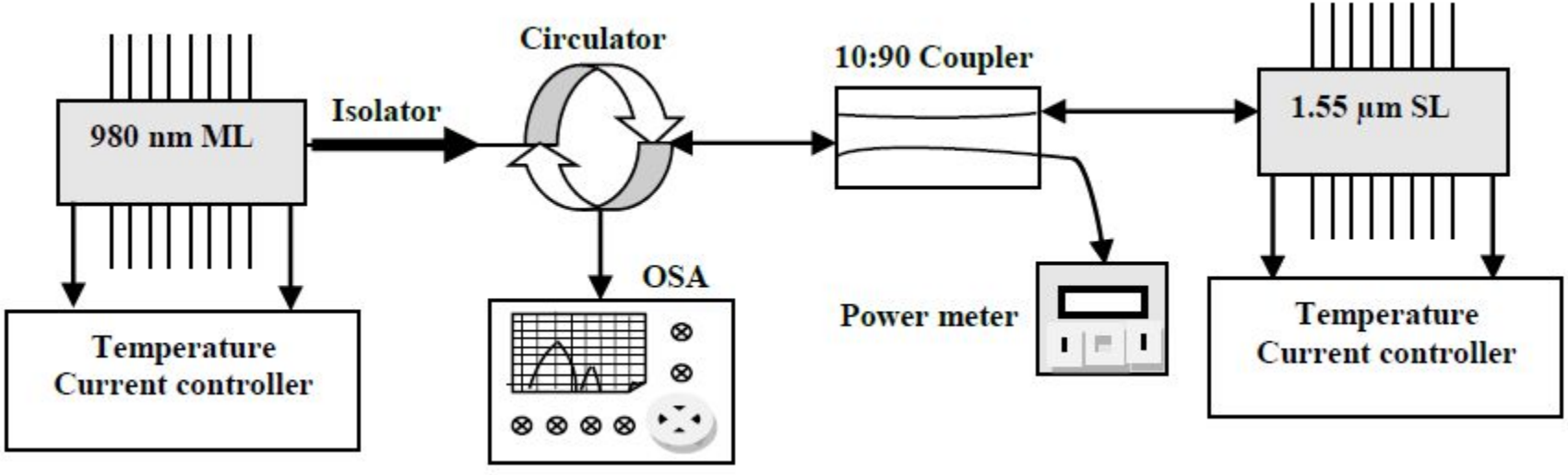
- ➔ Distributed feedback (DFB) laser devices are commonly used in network and optical communication system.
- ➔ In general, the grating of the DFB laser is formed in the vicinity of the active region to be used in such an applications
- ➔ the conventional DFB lasers suffer from low single-longitudinal-mode yield, poor operating wavelength accuracy and high cost of manufacturing process.
- ➔ The effect of 980 nm driven optical injection of laser on commercial 1550 nm DFB laser was studied at different temperatures.
- ➔ Further study on the DFB laser behaviour was carried out using excitation wavelengths of 1426, 1460 and 1490 nm emitting semiconductor laser at different operating currents and temperatures.

What is a DFB Laser?

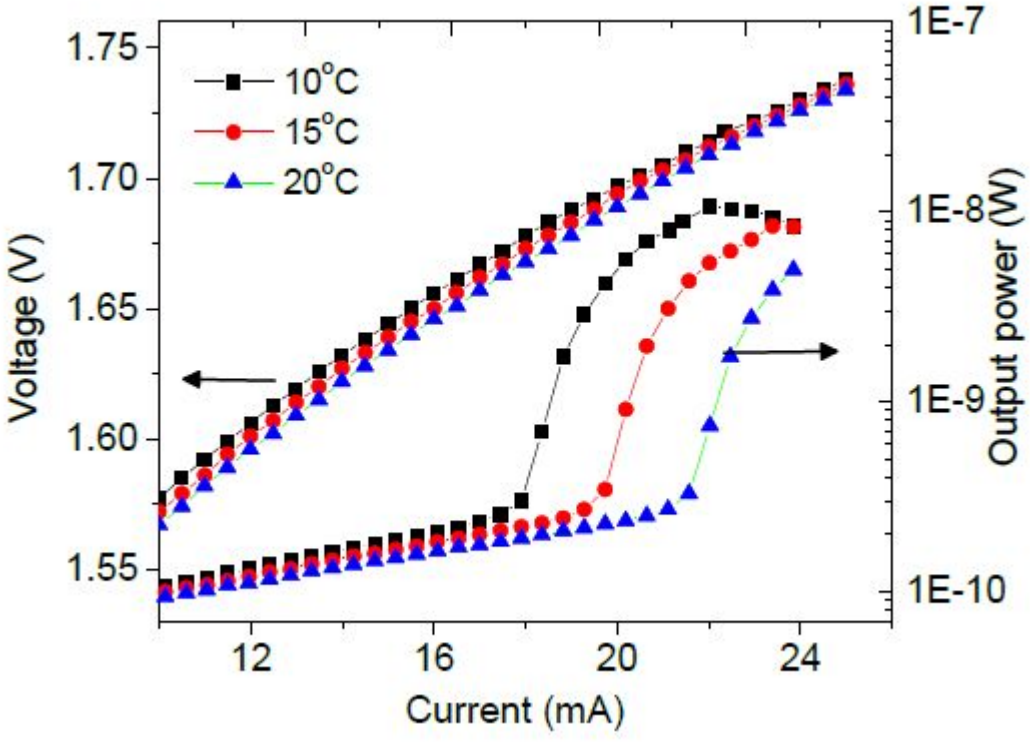


In DFB devices a grating is fabricated in above or below the active layers, and has the same length as the active region, while in DBRs, the grating is outside of the area of the active laser gain region.

Experimental setup of the 1550 nm DFB laser under using 980 nm pump laser

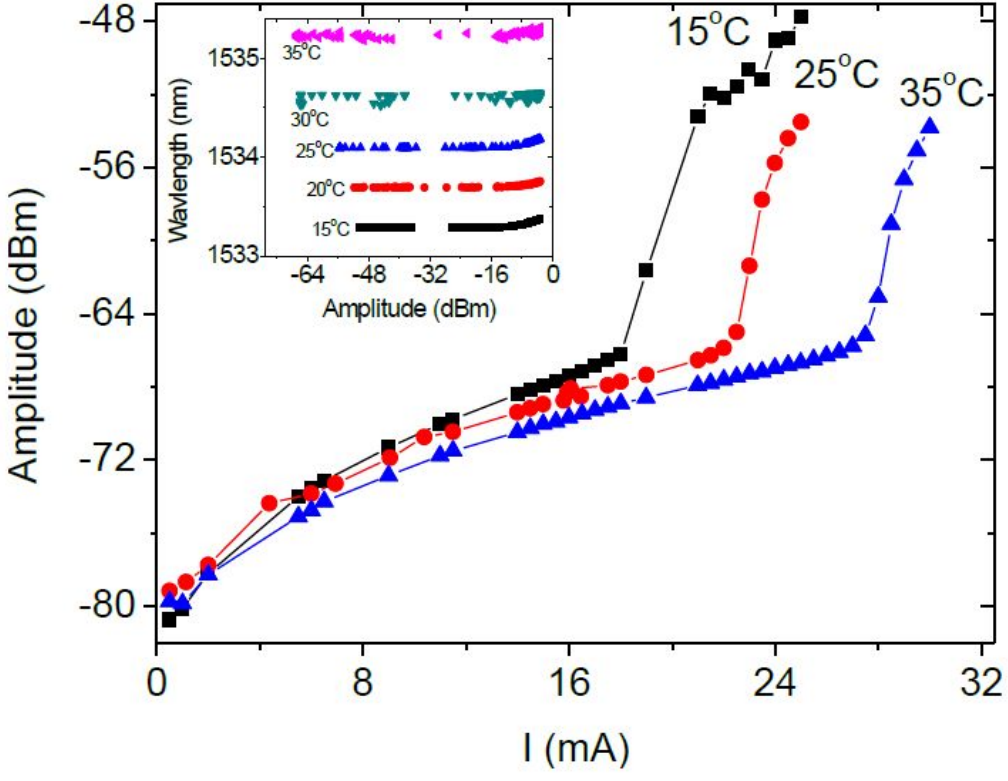


Results and Discussions

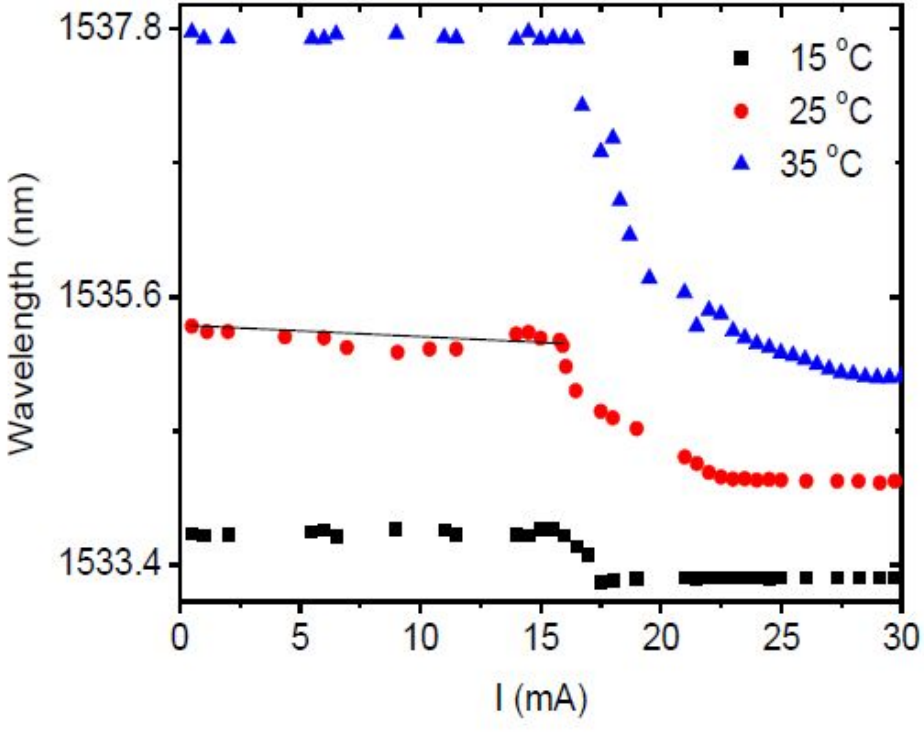


V-L-I characterisations for the DFB laser investigated in CW operation at various temperatures

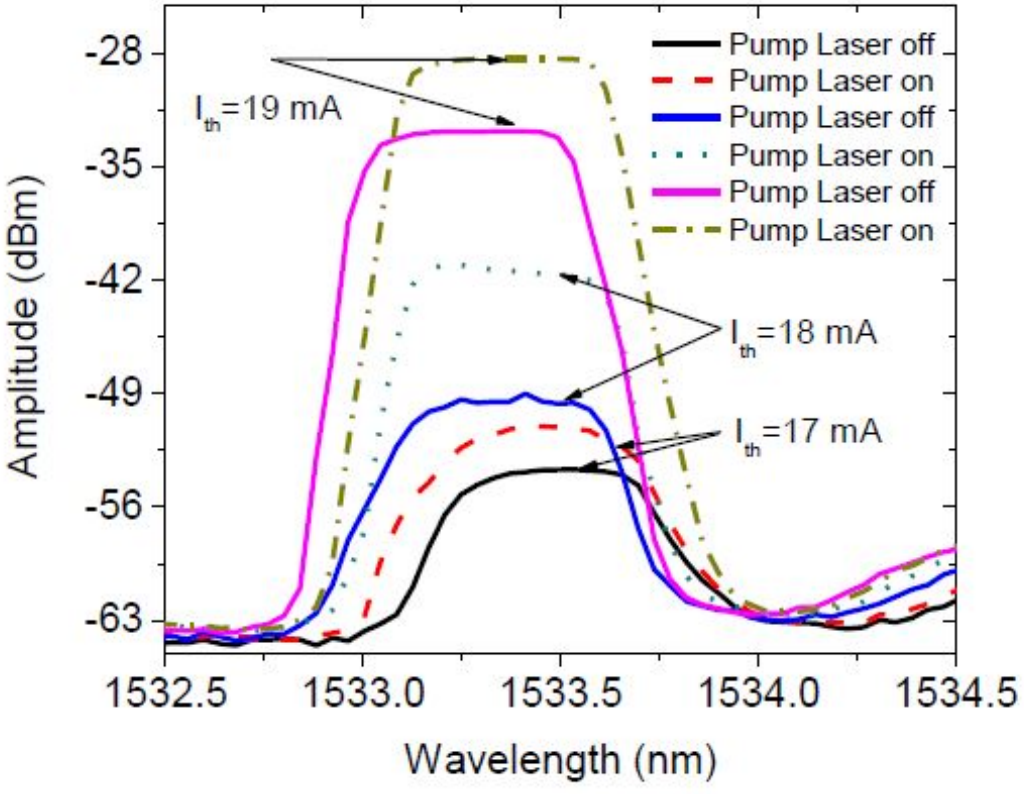
Amplitude of DFB laser as a function of driven currents at T=15, 25 and 35 oC. The inset shows amplitude versus wavelengths at various temperatures.



Wavelength variation with the change in an injected current at temperatures of T=15, 25, and 35 oC

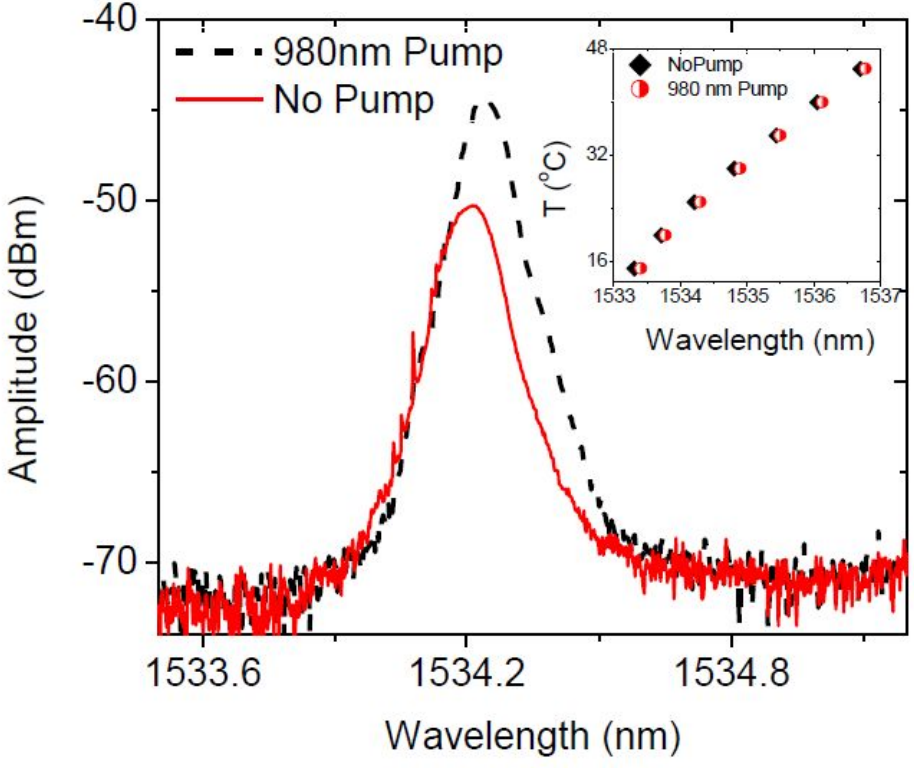


Measured spectra from the DFB laser at various threshold currents of Ith=17, 18 and 19 mA under pump laser off and on at temperature of T=15 oC



Emission spectra of DFB versus wavelength at T=25 oC and Ith=22 mA using 980 nm pump laser at pump current of IP=200 mA and without pump laser at T=25 oC.

The inset shows temperature against wavelength with pump and without pump lasers.



Conclusions

- we have measured the effect of an optical injection of 980 nm beam into 1550 nm commercial DFB laser.
- When the pump laser switched on, an optical amplification at around 6 dB is demonstrated at peak emission wavelength of about 1534 nm.
- The emission spectra of the device were also measured at various threshold current and temperatures when the pump laser is off or on.
- Such measurements could lead to the design of devices as in amplifiers, according to the injected signal.