915 nm Pumped 1018 nm Yb-Doped All-Fiber High Power Fiber Laser System

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Fibers lasers have attracted great attention in the last decades and the power scaling has reached tens of kW levels. Especially with the tandem pump configuration, pumping the active medium with a pump laser light instead of a diode laser, has made a breakthrough and so many research has been conducted about 1018 nm fiber laser systems [1]. Decreasing the quantum defect, the slope efficiency could be increased up to 90 % levels; on the other hand, due to the emission cross section of the Ytterbium (Yb), to operate the laser in the 1018 nm wavelength region is very challenging because of the presence of the ASE about the 1030 nm region. However, in the literature by using 976 nm pump diodes multi-hundred watts level 1018 nm fiber lasers could be demonstrated [2, 3].

In this work, we have developed a 1018 nm high power fiber laser by pumping with a 915 nm pump diode instead of 976 nm pump diode. Additionally, by changing the wavelength of the pump source from 904 nm to 924 nm with a 20 nm span we have showed the laser action continue with a stable efficiency.

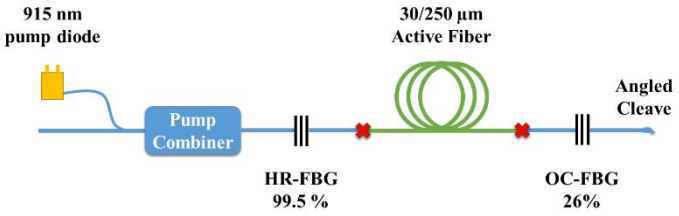

Fig. 1 Schematic illustration of 1018 nm fiber laser system.

We have established a setup which includes a 915 nm high power pump diode combined to a pump combiner and a pair of FBGs working at 1018 nm wavelength and an active fiber having core/cladding diameters 30/250 µm respectively as shown in Fig.1.

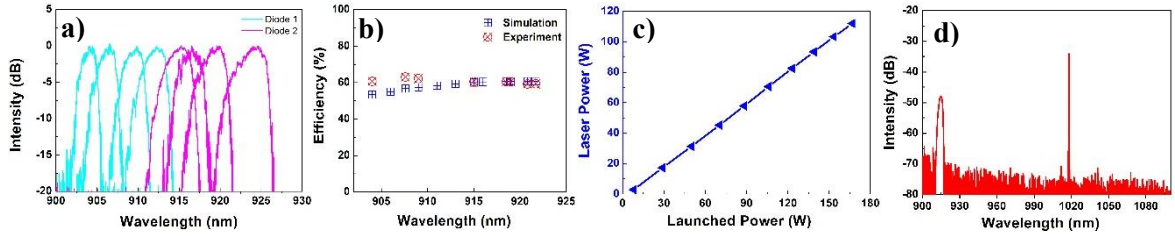

Fig. 2 Optical spectrum characterization of two different pump sources with the help of a heater (a), the efficiency change with respect to the change in the pump wavelength (b), power characterization of the 1018 nm fiber laser (c) and the optical spectrum at its maximum power (d).

Firstly, we have characterized the central wavelength change of pump diodes by increasing their temperatures as in the Fig. 2(a) and tested the change in the laser efficiency and observed that the experimental results coincide with the simulation performed by RP-Fiber Power software as in the Fig. 2(b). Finally, we have tested the high power performance of the laser system and obtained a power above 100 W as shown in Fig. 2(c) and the corresponding optical spectrum at its maximum power shown in Fig. 2(d). Therefore, we have succeeded to demonstrate the first that 1018 nm fiber laser systems could be pumped by 915 nm pump wavelength region as well. As a result, benefiting from the broad absorption region of Yb atoms around 915 nm wavelength region we have also demonstrated that stable 1018 nm fiber laser systems could be developed.

References

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