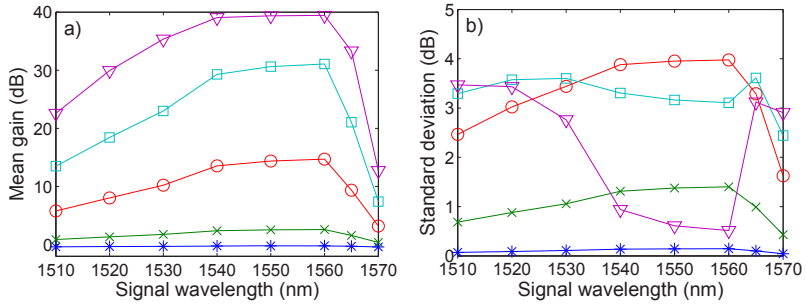

Fig. 5. (a) - Mean signal gain. (b) - Standard deviation gain. Signal input power equal to 1 mW, pump wavelength equal to 1450 nm, and pump powers equal to 0.1, 1, 4, 8 and 12 W (asterisks, crosses, circles, squares and triangles, respectively).

pump powers higher than 4 W. This means that pump depletion makes the signal gain independent of the input signal SOP. Although not presented here, we have carried out simulations for $L_B = 35$ m ($D_p = 0.022$ ps/km$^{1/2}$) in both depleted and undepleted pump regimes. Our results showed that the Raman pulling process efficiency remains stable into the considered range of PMD values, i.e., from 0.0021 up to 0.022 ps/km$^{1/2}$, for both pump regimes.

We modeled pump and signal as continuous waves, neglecting the walk-off effect between pump and signal. Nevertheless, the signal DOP will certainly be influenced by pump power fluctuations. Our signal DOP maps, presented in Fig. 2(a) and Fig. 4(a), show that the domains of smallest gradients (along the y direction - pump power) tend to correspond to the highest DOP values. Therefore, systems operating with a Raman pump in such power range will tend to present an enhanced signal DOP tolerance with respect to pump power fluctuations. Therefore, the signal DOP dependence of pump power fluctuations can in principle be mitigated by choosing an appropriate pump power.

4. Conclusions

We showed that all-optical polarization control based on Raman scattering can be obtained over a wavelength range of 60 nm. The efficiency of the pulling process is higher close to the Raman gain peak, where the DOP is roughly constant for a wavelength range of 15 nm. For shorter and longer wavelengths, higher pump powers are required in order to assure maximum efficiencies: for instance, a DOP equal to 0.9 is obtained at 1550 nm for a pump power around 4 W, whereas the double power is needed in order to obtain the same DOP at 1510 nm, considering $\lambda_p =$ 1450 nm. In spite of the random pump SOP evolution along the propagation, we found that the mean angle between the output signal and pump Stokes vectors becomes smaller when the signal output DOP is close to 1. The output pump SOP information can therefore be used in order to operate on the output signal SOP. Different results were found in the depleted regime, where the highest DOP values are no more observed for the highest pump powers. For signal wavelengths between 1535 and 1560 nm, the highest DOP values occur for a optimum pump power, which in our case was 8 W. For powers higher than the optimum value, the polarization pulling effect becomes less efficient due to the decrease of the pump DOP.

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