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Abstract: We investigate, both experimentally and theoretically, Brillouin backscattering in a 50-cm long high-index (n=1.7) doped-silica glass photonic chip waveguide. The Brillouin spectrum features a broad (350 MHz) acoustic resonance at 16 GHz, in good agreement with theory and numerical simulations. Brillouin gain was estimated to be around 0.09 $m^{-1}W^{-1}$.

Stimulated Brillouin scattering (SBS) is an invaluable tool for processing light and microwave, as well as for the development of optical sensors, frequency combs, and lasers [1]. While SBS has been exploited earlier on within optical fibers, it is only recently that it has been observed in CMOS-compatible integrated waveguides based on chalcogenide (ChG), silica (SiO_2), silicon (Si), or silicon nitride (Si_3N_4) [1]. Here, we report the observation of Brillouin backscattering in a 50-cm long spiral high-index doped silica glass integrated waveguide, whose cross-section is depicted in Fig. 1(a) [2]. Fig. 1(b) shows the reflectometer trace that measures total insertion loss (8.9 dB) and linear loss (0.1 dB/cm), and Fig. 1(c) is the experimental setup for measuring the Brillouin backscattering spectrum at 1550 nm. The experimental spectrum for a pump power of 18 dBm is shown in Fig. 1(d). It features a broad Brillouin peak at 16 GHz due to the high-index waveguide and a sharper one at 10.8 GHz due to the silica fibers in the setup. Fig.1 (e) is the numerical simulation of the Brillouin gain spectrum and the insets show the computed optical (top) and elastic (bottom) modes (See Ref [2] for details). As it can be seen, the agreement is quite excellent. We find a Brillouin shift at 16 GHz and a peak gain of g_b=0.09 $m^{-1}W^{-1}$ from simulations. These integrated waveguides could potentially find Brillouin-based applications if we find a way to increase the gain while reducing the linewidth.

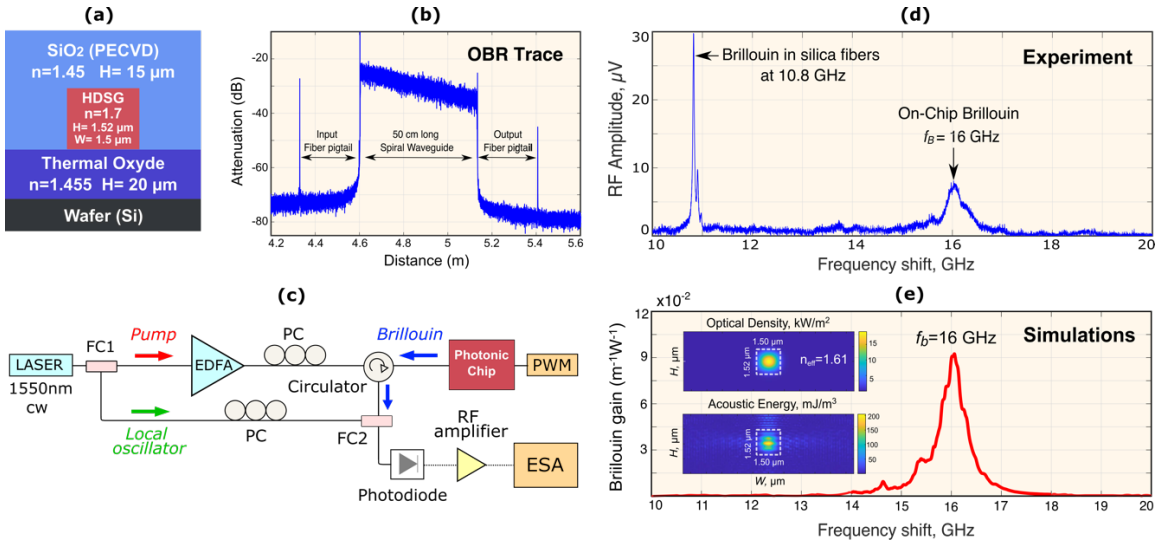

Figure 1: Results of Brillouin backscattering in high-index doped silica chip waveguide

References

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2. M. Zerbib, V.T. Hoang, J.C. Beugnot, K.P. Huy, B. Little, S.T. Chu, D.J. Moss, R. Morandotti, B. Wetzel, T. Sylvestre, Res. in Phys. 52, 106830 (2023).