

TELECOMMUNICATIONS OPTICAL FIBER RAMAN GAIN SPECTRUM MEASUREMENT

Andis Supe, Jurgis Porins

Institute of Telecommunications, Riga Technical University, LV 1048 Riga, Latvia

e-mail: andis.supe@rtu.lv

The Raman-gain spectrum $g_R(\Omega)$, where Ω is the frequency difference between the pump and Stokes waves, is the most important parameter for describing stimulated Raman scattering (SRS) process. In general, $g_R(\Omega)$ depends on the fiber core profile and can vary significantly with the use of different dopants to the silica [1]. In this research we performed the $g_R(\Omega)$ measurement for silica based highly nonlinear fiber.

The Raman scattering in optical fibers occurs over a relatively large frequency range (~40THz) because several vibrational modes occur in the structure of amorphous silica, with resonance frequencies that overlap with each other and form a broad frequency bands [2]. Due to this characteristic SRS is widely used into the optical signal amplification.

To achieve the $g_R(\Omega)$ parameter the measurement of optical signal amplification in the studied fiber due to SRS was performed. Due to lower required pump power we took into consideration only Stokes wave that is generated into backward direction. Therefore the pump and signal laser sources were connected to opposite ends of the fiber. Pump laser's wavelength is 1426nm, but signal laser's wavelength was changed from 1505 – 1640nm that is practically the entire third optical transparency window used in telecommunications. After the signal gain measurement it is possible to calculate the $g_R(\Omega)$. In the figure above the studied highly nonlinear fibers's Raman gain is given. Maximum gain value for this fiber is for $\Omega = 13.1\text{THz}$ that in comparison to fused silica maximum $g_R(\Omega)$ differs by 100GHz.

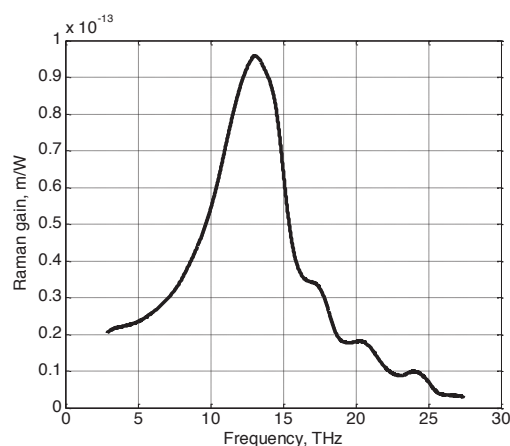


Fig.1 Measured Raman gain spectrum for the studied highly nonlinear optical fiber.

References

1. Agrawal G. P. Nonlinear fiber optics. Third Edition – San Diego: Academic Press, 2001. - 453 p.
2. Mario F. S. Ferreira Nonlinear Effects in Optical Fibers, Wiley & Sons, 2011. -240 p.