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High Transmission Data Rate of Plastic Optical Fibers over Silica Optical Fibers Based Optical Links for Short Transmission Ranges

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***Abstract*— This paper has proposed two different fiber structures for dispersion management are investigated, where two types of fabrication material link of single mode fiber made of pure silica and plastic optical fibers are suggested, where one successive segment of single mode fiber made of silica fibers is suggested to be employed periodically in the short transmission systems namely different relative refractive index differences (Δn). As well as we have presented the total transmission characteristics of both materials based optical links under the thermal effect of to be processed to handle both transmission lengths and bit rates per channel for cables of multi links over wide range of the affecting parameters. Within maximum time division multiplexing (MTDM) transmission technique, we have estimated both the transmission bit rate and capacity distance product per channels for both materials based optical links under study. The bit rates are studied within thermal and dispersion sensitivity effects of the refractive-index of the materials based optical links are taken into account to present the effects on the performance of optical fiber cable links. Dispersion characteristics and dispersion management are deeply studied where two types of optical fiber cable link materials are used. A new novel technique of chromatic dispersion management in optical single mode fiber is introduced to facilitate the design of the highest and the best transmission performance of bit rates in advanced local area optical communication networks.**

***Index Terms*— Single Mode Fibers (SMFs), Dispersion Management, High Data Rate, Optical Link Design and Thermal Effects**

I. INTRODUCTION

OPTICAL fiber communications technology has been extensively employed and deployed in global communications networks and throughout terrestrial systems; from fiber to the home schemes in several countries to internetworking between countries and major cities [1]. The enormous bandwidth of optical fibers and advancement of 0optical communications technology together with the direct photon to photon amplification make possible several innovative configurations of optical transmission systems and distribution networks. Current deployment of optical signals over single mode optical fibers in the filed are only based on single channels either at 1310 nm or 1550 nm windows [2], except in some field trail systems and networks. It is essential that these enormous bandwidth regions should be used extensively. Intense investigation and experiments of ultra-long and ultra-high speed optical communication systems have been carried out together with interests in the multiplexing of optical carriers in the same fiber channel; the wavelength division multiplexing techniques have been used as the unique technology [3].

Current conventional amplification and dispersion compensation and management have assumed great importance as there are the main impairing factors for achieving repeater less transmission distance in excess of 100 km over standard single mode fibers. One of the earliest techniques suggested to reduce the dispersion at 1550 nm band was to tailor the refractive index profile of a single mode fiber in such a way that its zero dispersion wavelength is shifted from the conventional 1310 nm window to a round 1550 nm [4]. These fibers, called dispersion shifted fibers (DSF) through appeared promising for a while, but, were found to be unusable in dense wavelength division multiplexing (DWDM) link due to the fact that operating a fiber with near zero dispersion is known to introduce nonlinear effects like four wave mixing (FWM) [5]. It is known that FWM effect can be greatly reduced by allowing a small but finite local dispersion all along a DWDM link. This task could be fulfilled either through dispersion management (i.e. by combing alternate lengths of positive and negative dispersion fibers [6]) or by employing so called nonzero dispersion shifted fibers. Which is designed to leave a small residual average dispersion of 2.6 ps/km to omit nonlinear propagation effects in the single mode fiber?

Chromatic dispersion is a linear effect and inserting a component with opposite sign could greatly reduce its detrimental effect in G.652 fibers at the 1550 nm band. Out of the several different technique that have been proposed in the literature, the ones which seem to hold immediate promise could be classified as dispersion compensating fiber (DCF)[7], chirped fiber Bragg grating (FBG) [8],[9], high order mode (HOM) fibers[10]. In chirped grating the optical pitch (product between the grating period and the mode effective index) varies along length of the FBG. As a result, resonant reflection frequency of the FBG becomes a function of position along length of FBG. Thus, each frequency component of a propagating pulse is reflected from a different point along length of chirped FBG. This is depending on the sign of the chirp; a chirped FBG could impart either a positive or negative dispersion to a propagating pulse [11]. Since, dispersion compensation is achieved or reflection to access the dispersion corrected pulse. And optical circulator or a fiber coupler is required as an additional component with associated insertion loss.

Furthermore, errors in the chirped phase mask periodicity could lead to ripples in group delay with wavelength [12].

In the present study, plastic optical fibers (POFs) are the most promising solution for the "last 100 m to 1000 m" in high data communications over conventional silica optical fibers for short transmission ranges. The combine the inherent benefits of all optical fibers such as high bandwidth, total electromagnetic immunity with additionally amazing simplicity in handling. These benefits make POFs attractive for a wide variety of applications for short transmission range media.

II. MODELING BASICS AND ANALYSIS

A. Simplified Dispersion Model Analysis

The standard single mode fiber link cable is made of both materials under study which the investigation of the spectral variations of the waveguide refractive-index, n requires empirical equation under the form [13]:

$$n^2 = 1 + \frac{A_1 \lambda^2}{\lambda^2 - A_2^2} + \frac{A_3 \lambda^2}{\lambda^2 - A_4^2} + \frac{A_5 \lambda^2}{\lambda^2 - A_6^2} \quad (1)$$

The empirical equation coefficients as a function of ambient temperature and room temperature as: A_{1S}=0.691663, A_{2S}=0.03684043 $(T/T_0)^2$, A_{3S}=0.4079426, A_{4S}=0.0116241 $(T/T_0)^2$, A_{5S}=0.8974749, A_{6S}= 84.76543 $(T/T_0)^2$. Where T is ambient temperature in K, and T_0 is the room temperature and is considered as 300 K. Second differentiation of empirical equation w. r. t operating wavelength λ as in Ref. [14]. For the plastic fiber material, the coefficients of the Sellmeier equation and refractive-index variation with ambient temperature are given as: A_{1P}= 0.4963, A_{2P}= 0.6965 $(T/T_0)^2$, A_{3P}= 0.3223, A_{4P}= 0.718 $(T/T_0)^2$, A_{5P}= 0.1174, and A_{6P}= 9.237. The maximum bit rates are determined by numerous factors, including the signal modulation rate, the transmission bandwidth through the transmission media, and the response time of the optoelectronic devices. The pulse broadening of grating-based multiplexing communication system imposes inherent limitations on the data transmission bit rates. The total chromatic dispersion in standard single mode fiber that limits the bit rates in system based ultra multiplexing communication system can be calculated as follows [15]:

$$D_t = -\left(M_{md} + M_{wd}\right),\ n\sec/nm.km \quad (2)$$

Where M_{md} is the material dispersion coefficient in nsec/nm.km, M_{wd} is the waveguide dispersion coefficient in nsec/nm.km, The material dispersion coefficient is given as:

$$M_{md} = -\frac{\lambda_s}{c}\frac{d^2 n}{d\lambda^2} - \frac{\Delta\lambda}{2c}\left(\frac{d^2 n}{d\lambda^2}\right), \quad (3)$$

The waveguide dispersion coefficient is given by:

$$M_{wd} = -n_{cladding}\left(\frac{\Delta n}{c\,\lambda_s}\right)F(V), \quad (4)$$

Where n is the refractive index of the cladding material, c is the velocity of light ($3x10^8$ m/sec), Δn is the relative refractive-index difference, λ_s is the optical signal wavelength, F (V) is a function of V number or normalized frequency. Based on the work [16], they designed the function F (V) is a function of V as follows:

$$F(V) = 1.38V - 6.98V^2 + 13.45V^3 - 4.84V^4 - 1.48V^5 \quad (5)$$

When they are employing V-number in the range of (0 ≤ V ≤ 1.15) yields the above expression. In our simulation model design, we are taking into account V-number as unity to emphasis single mode operation. Where the total dispersion coefficient (nsec/nm.km) in the plastic fiber link is given by:

$$D_t = \left(W_{md} + P\right) \quad , \quad (6)$$

In which both material and profile dispersions were taken into account as W_{md} and P respectively [16]:

$$W_{md} = \left(-\frac{\lambda^3}{c}\left(\frac{dn}{d\lambda}\right)^2 - \frac{2\lambda}{c}\left(\frac{d^2 n}{d\lambda^2}\right)\left(N_1 \Delta n\right)C_1\left(\frac{2\alpha}{\alpha+2}\right)\right)^{0.5} \quad (7)$$

$$P = \left(\left(\frac{N_1 \Delta n}{c\lambda}\right)^2\left(\frac{\alpha - 2 - \varepsilon}{\alpha+2}\right)^2 \times \frac{2\alpha}{3\alpha+2}\right)^{1/2} \quad (8)$$

Where N_1 is the group index for the mode which is given by:

$$N_1 = n - \lambda\frac{dn}{d\lambda} \quad , \quad (9)$$

Where C_1 is a constant related to index exponent and profile dispersion and is given by:

$$C_1 = \frac{\alpha - 2 - \varepsilon}{\alpha + 2} \quad , \quad (10)$$

Where α is the index exponent, and ε is the profile dispersion parameter and is given by:

$$\varepsilon = -\frac{2n}{N_1}\frac{\lambda}{\Delta n} \quad , \quad (11)$$

B. MTDM Transmission Technique

To achieve a high data transmission bit rate in the telecommunication field is the goal of wavelength division multiplexing technology. The maximum bit rates are determined by numerous factors, including the signal modulation rate, the transmission bandwidth through the transmission media, and the response time of the optoelectronic devices. In ultra multiplexing communication system is simply one part of the transmission regime. Therefore, the total pulse broadening due to the first order dispersion in standard single mode fiber (SSMF) that limits the bit rates in system based multiplexing communication system can be expressed as [17]:

$$\Delta\tau = D_t . \Delta\lambda \ . L \ ,\ n\sec/nm.km \quad (12)$$

Where Δλ is the spectral linewidth of optical source in nm, and L is the transmission link length in km. The pulse broadening of grating based multiplexing communication system imposes inherent limitations on the transmission bit rates. Then the MTDM transmission bit rate per channel is given by [18]:

$$B_{rmc} = \frac{1}{4\Delta\tau} = \frac{0.25}{\Delta\tau},\ Gbit/\sec/channel \quad (13)$$

Then the MTDM transmission bit rate per link is given as:

$$B_{rml} = \frac{0.25 . N_{link}}{\Delta\tau},\quad Gbit/\sec/link \quad (14)$$

The available MTDM transmitted bit rate B_{rm} is compared as the fiber cable length, L, and consequently the MTDM product P_{rmc} per channel is computed as [19]:

$$P_{rmc} = B_{rmc} \ . L \ ,\ Gbit.km/\sec \quad (15)$$

Also, in the same way, the MTDM product P_{rml} per link is computed as the following expression:

$$P_{rml} = B_{rml} \ . L,\ Gbit.km/\sec \quad (16)$$

As well as the transmitted signal bandwidth within single mode fibers based optical link can be [20]:

$$B.W_{Sig.} = \frac{0.44}{\Delta\tau \ L} \quad , \quad (17)$$

Fig. 1. Sensitivity concept analysis

The thermal sensitivity is the guide of the measurement the relative variations of the output (response, effect) and the relative variations of the input (Excitation, cause) as shown in Fig. 1:

The MTDM bit rate within thermal and dispersion sensitivity coefficients are taken into account as criteria of a complete comparison between silica and plastic fibers for based link design and are given by [21]:

$$S_T^{B_{rm}} = \frac{T}{B_{rm}} \cdot \frac{dB_{rm}}{dT} \;, \quad (18)$$

The transmission bit rate thermal penalty as a function of temperature variations can be expressed as [22]:

$$P_T = \left[B_{rm}(T) - B_{rm}(T_0)\right] / B_{rm}(T_0) \;, \quad (19)$$

III. SIMULATION RESULTS AND PERFORMANCE ANALYSIS

We have been investigated the high data transmission bit rates of plastic optical fibers over silica optical fibers for short transmission applications in the interval of 1.3 μm to 1.65 μm under the set of affecting parameters at temperature range varies from 300 K to 330 K. The following set of the numerical data of system model design are employed to obtain transmission bit rate and capacity-distance product per channel as follows: 1.3 ≤ λ_s, central optical signal wavelength, μm ≤ 1.65, spectral line width of the optical source, Index exponent g=2.5, Δλ= 0.1 nm, 0.1 ≤ transmission link length, L, km ≤ 1, and 0.0275 ≤ Δn, relative refractive-index difference ≤ 0.0495. At the assumed set of operating parameters {optical signal wavelength λ_s, ambient temperature and refractive refractive-index difference}, both the effective performance of plastic and silica fibers are processed based on both the transmission bit rate and capacity-distance product either per link or per channel. The transmitted bit-rate per optical channel is also a special criterion for comparison for different fiber link materials of plastic and silica fibers. Based on the clarified variations in Figs. (2-22), the following facts are assured:

i) As shown in the series of Figs. (2-4) have assured that as ambient temperature, relative refractive index difference, and transmission distance increase, this leads to decrease in MTDM transmission bit rates per channel for both silica and plastic optical fibers based optical links. As well as plastic optical fibers have presented higher transmission bit rates per channel at the same conditions of operation compared to silica fibers.

ii) Figs. (5-7) have indicated that as ambient temperature, relative refractive index difference, and transmission distance increase, this leads to decrease in MTDM transmission bit rates per link for both silica and plastic optical fibers based optical links. Moreover plastic optical fibers have presented higher transmission bit rates per link at the same conditions of operation compared to silica fibers.

iii) As shown in the series of Figs. (8-13) have proved that as transmission link length increases, these results in increasing in MTDM product either per link or per channel. But as both relative refractive index difference and ambient increase, this results in decreasing of MTDM product either per link or per channel. As well as plastic optical fibers have presented higher MTDM product either per link or per transmitted channel at the same conditions of operation compared to silica fibers.

iv) Figs. (14-16) have assured that as transmission link length, ambient temperature, and relative refractive index difference increase, this leads to decrease in transmitted signal bandwidth for both plastic and silica fibers. Moreover plastic optical fibers have higher transmitted signal bandwidth compared to silica fibers.

v) As shown in the series of Figs. (17-19) have demonstrated that as operating optical signal wavelength, ambient temperature, and relative refractive index difference increase, these results in increasing bit rate thermal penalty for both silica and plastic optical fibers. As well as plastic optical fibers have presented lower bit rate thermal penalty compared to silica fibers at the assumed set of operating parameters.

vi) Figs. (20-22) have assured that as ambient temperature, operating optical signal wavelength, and relative refractive index difference increase, this leads to increase in bit rate thermal sensitivity for both plastic and silica fibers. Moreover plastic fibers have presented lower bit rate thermal sensitivity compared to silica fibers at the assumed set of operating parameters.

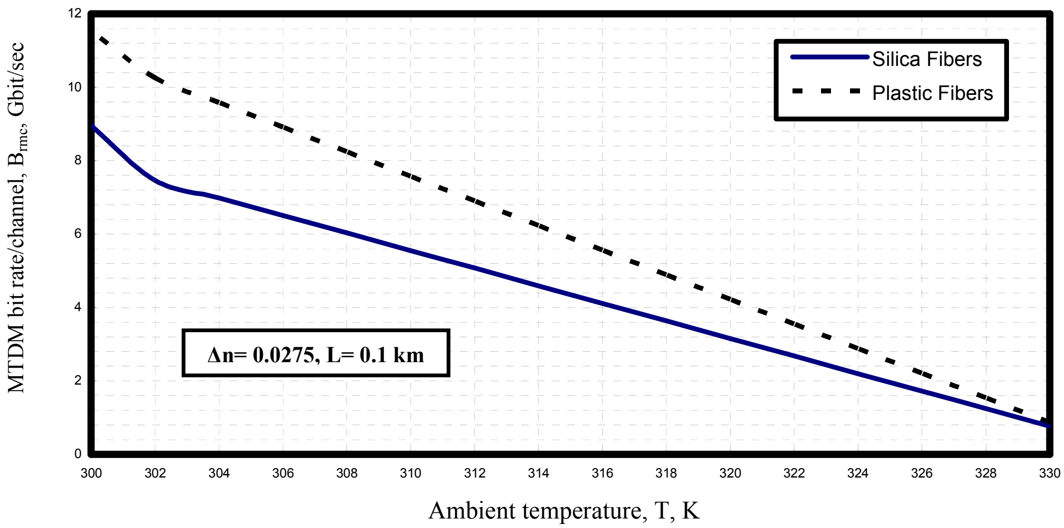

Fig. 2. Variations of MTDM transmission bit rate per channel versus ambient temperature at the assumed set of parameters.

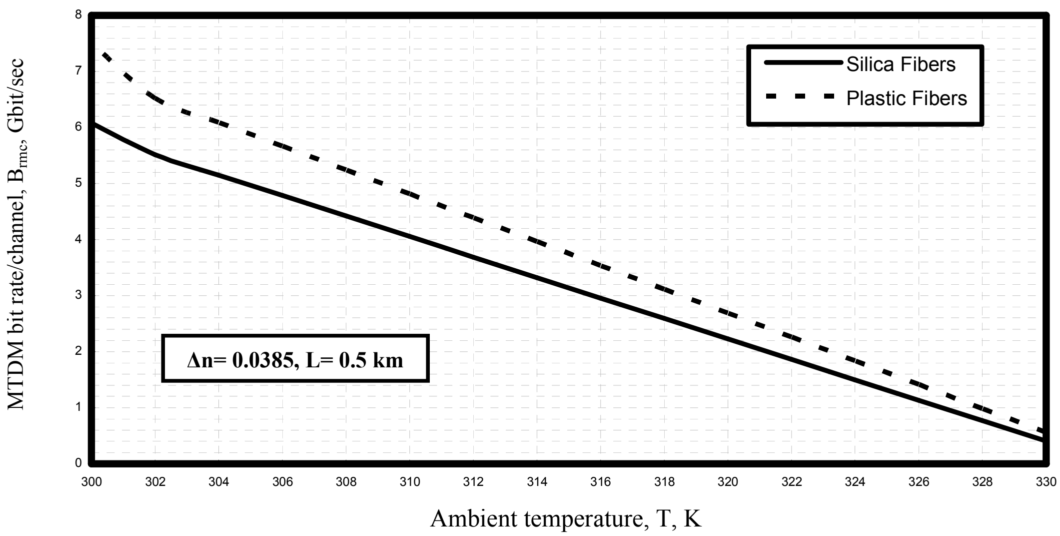

Fig. 3. Variations of MTDM transmission bit rate per channel versus ambient temperature at the assumed set of parameters.

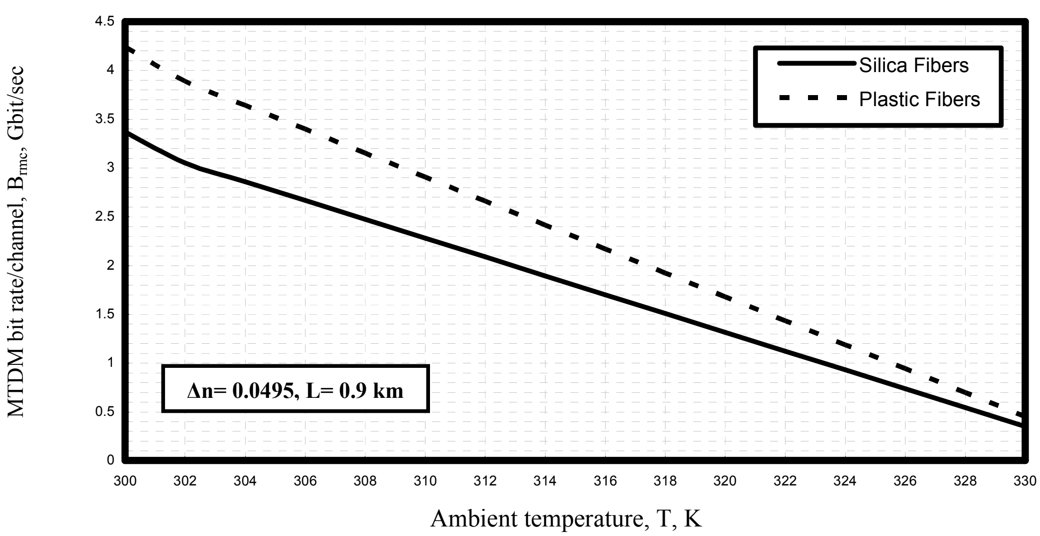

Fig. 4. Variations of MTDM transmission bit rate per channel versus ambient temperature at the assumed set of parameters.

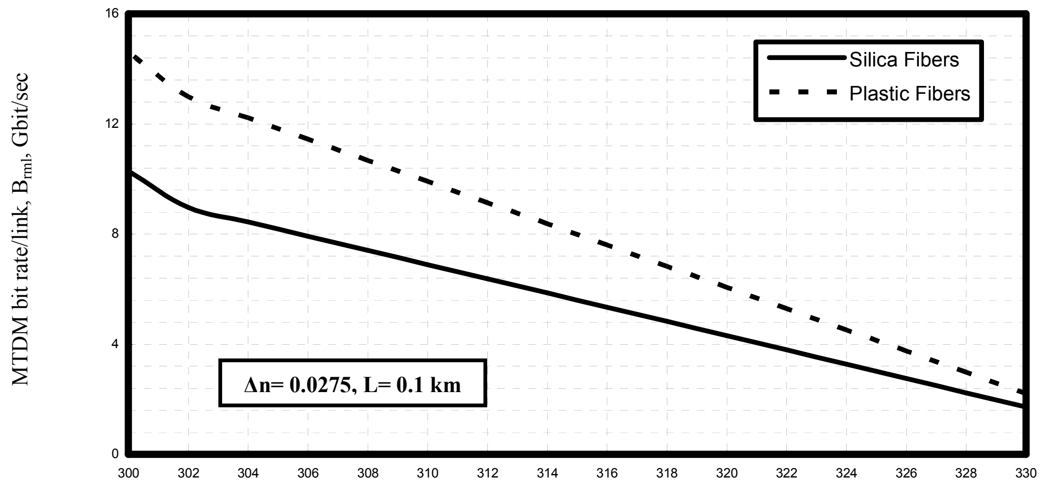

Fig. 5. Variations of MTDM transmission bit rate per link against ambient temperature at the assumed set of parameters.

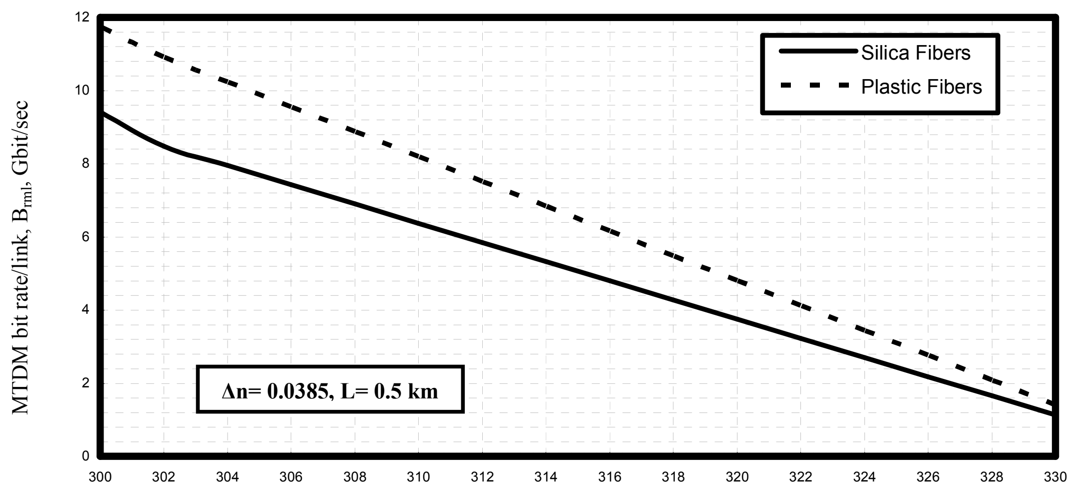

Fig. 6. Variations of MTDM transmission bit rate per link against ambient temperature at the assumed set of parameters.

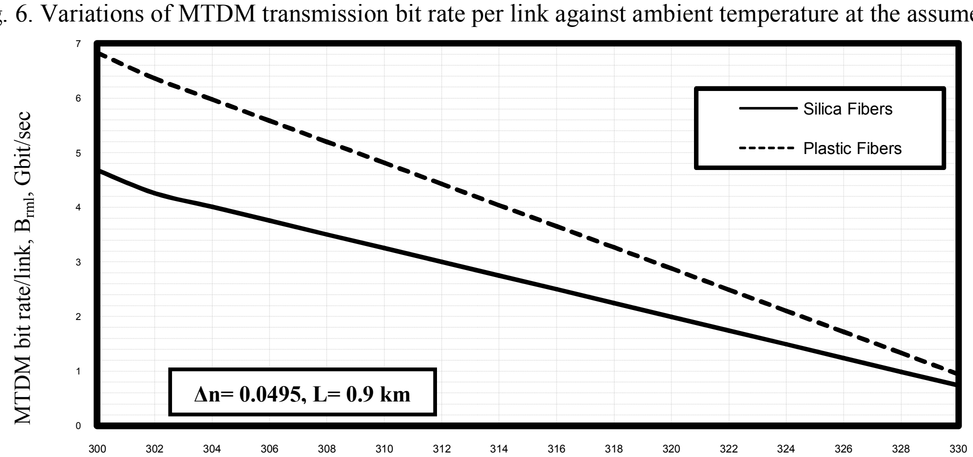

Fig. 7. Variations of MTDM transmission bit rate per link against ambient temperature at the assumed set of parameters.

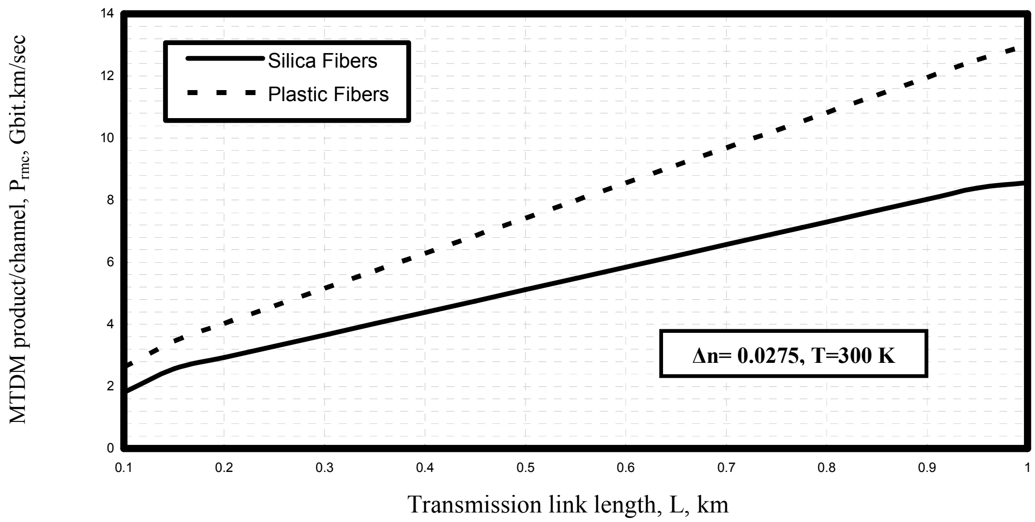

Fig. 8. Variations of MTDM product per channel against transmission link length at the assumed set of parameters.

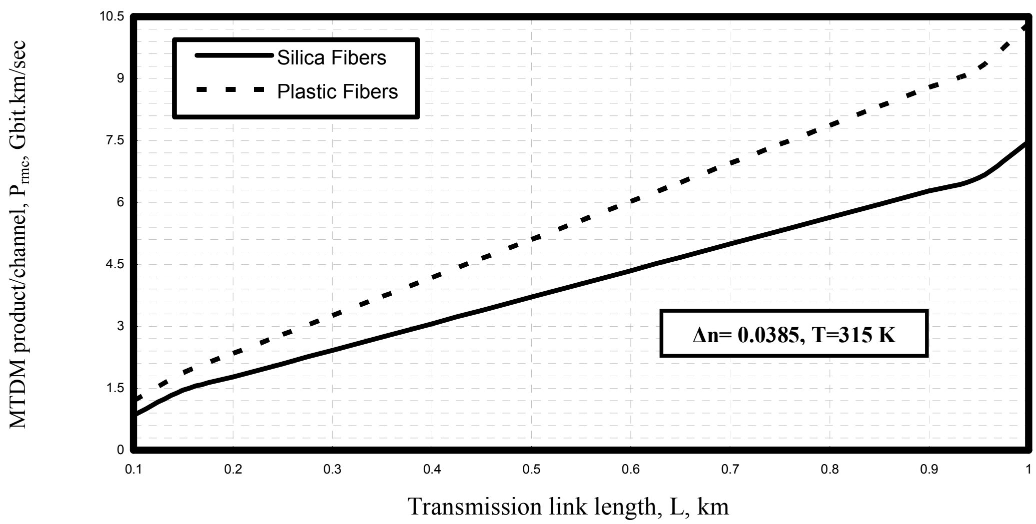

Fig. 9. Variations of MTDM product per channel against transmission link length at the assumed set of parameters.

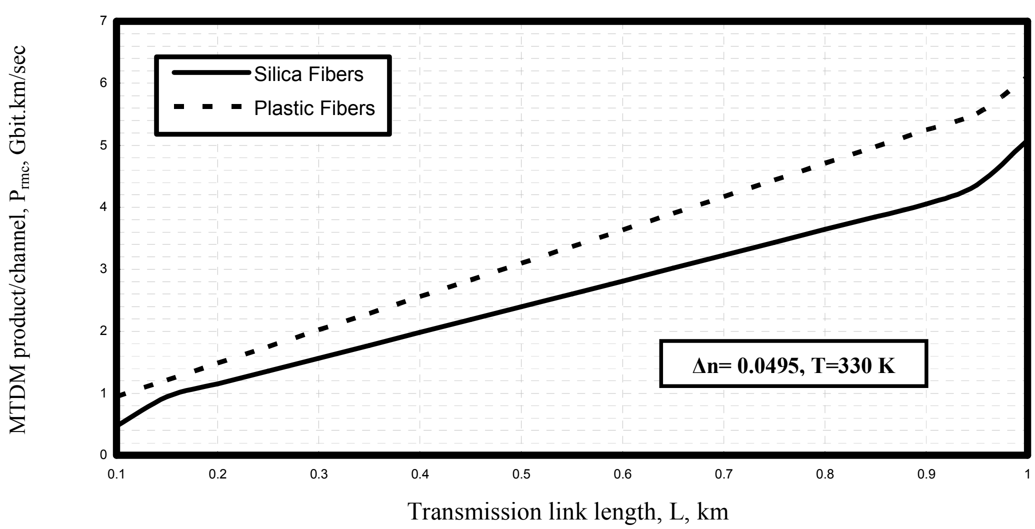

Fig. 10. Variations of MTDM product per channel against transmission link length at the assumed set of parameters.

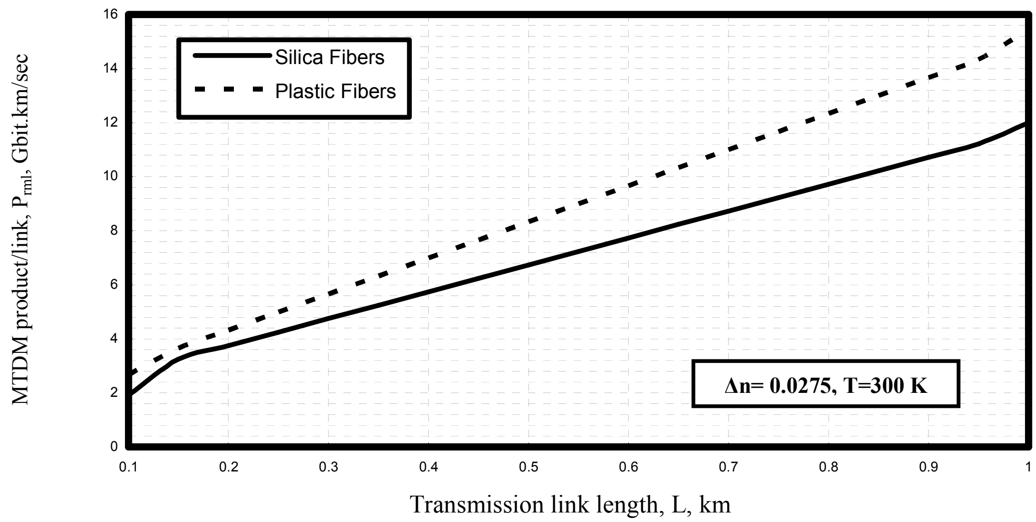

Fig. 11. Variations of MTDM product per link against transmission link length at the assumed set of parameters.

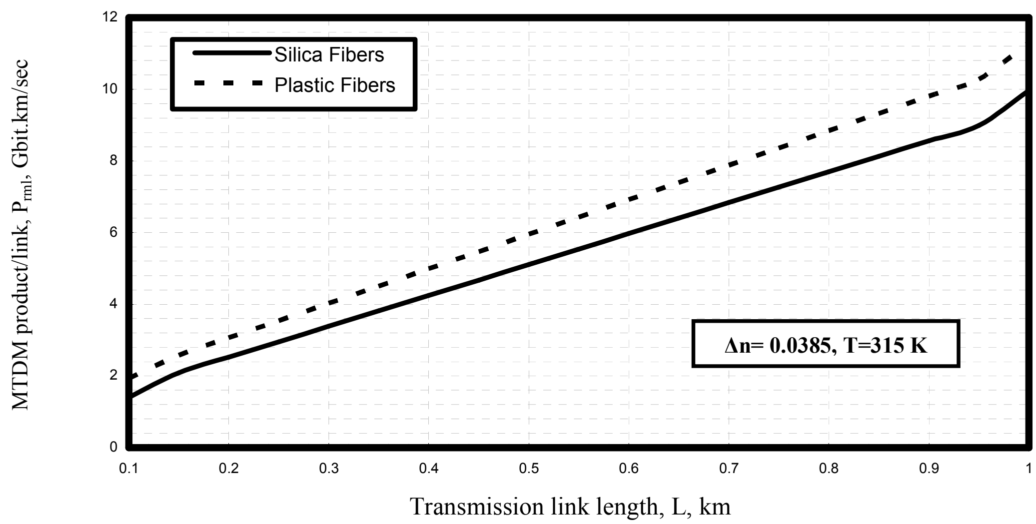

Fig. 12. Variations of MTDM product per link against transmission link length at the assumed set of parameters.

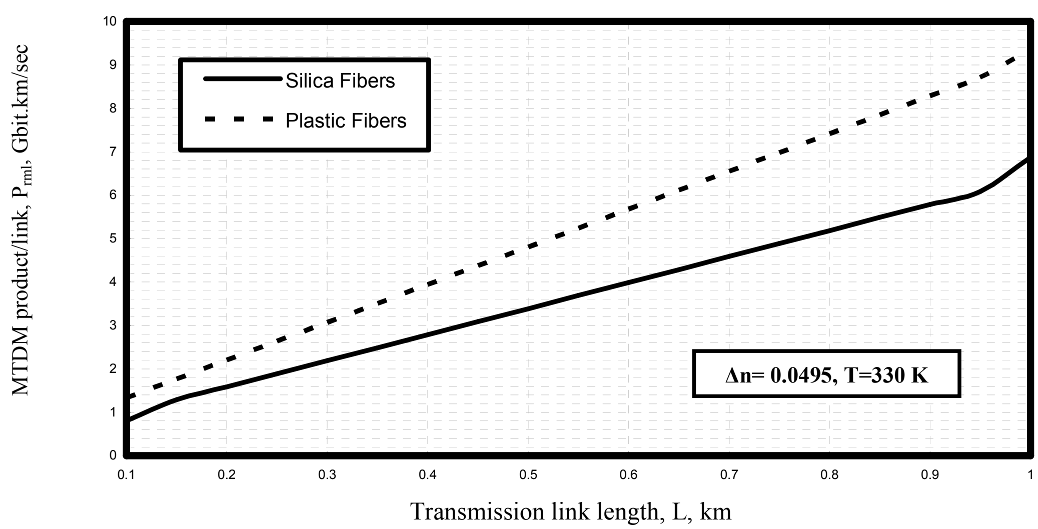

Fig. 13. Variations of MTDM product per link against transmission link length at the assumed set of parameters.

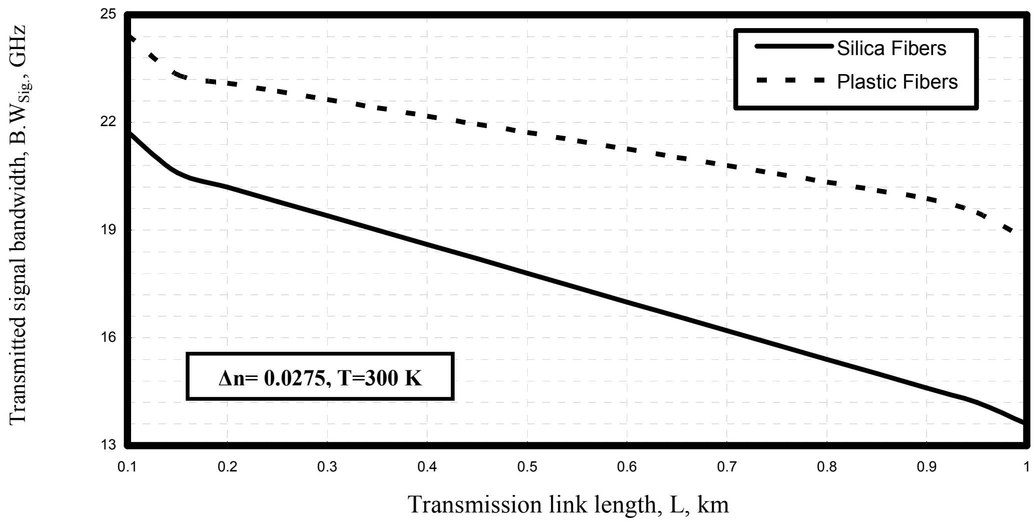

Fig. 14. Variations of transmitted signal bandwidth against transmission link length at the assumed set of parameters.

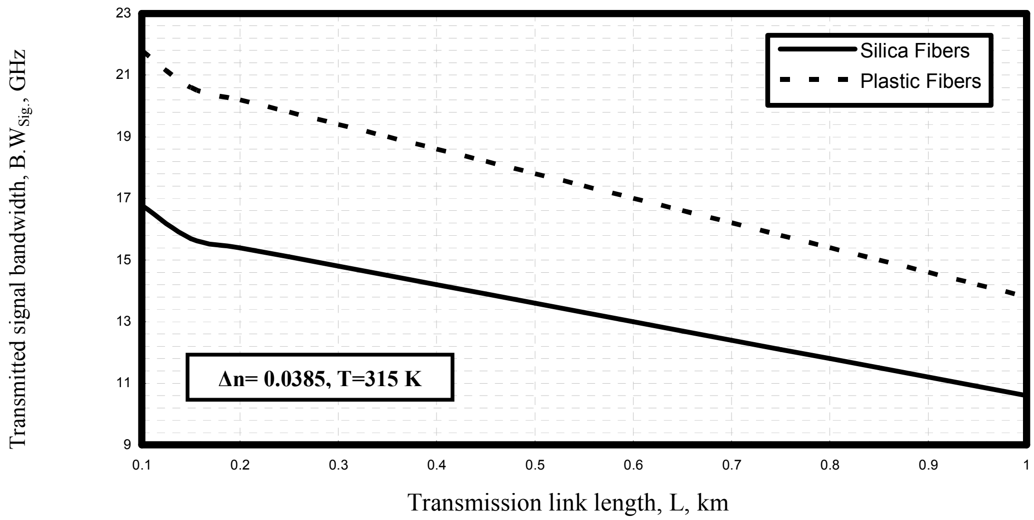

Fig. 15. Variations of transmitted signal bandwidth against transmission link length at the assumed set of parameters.

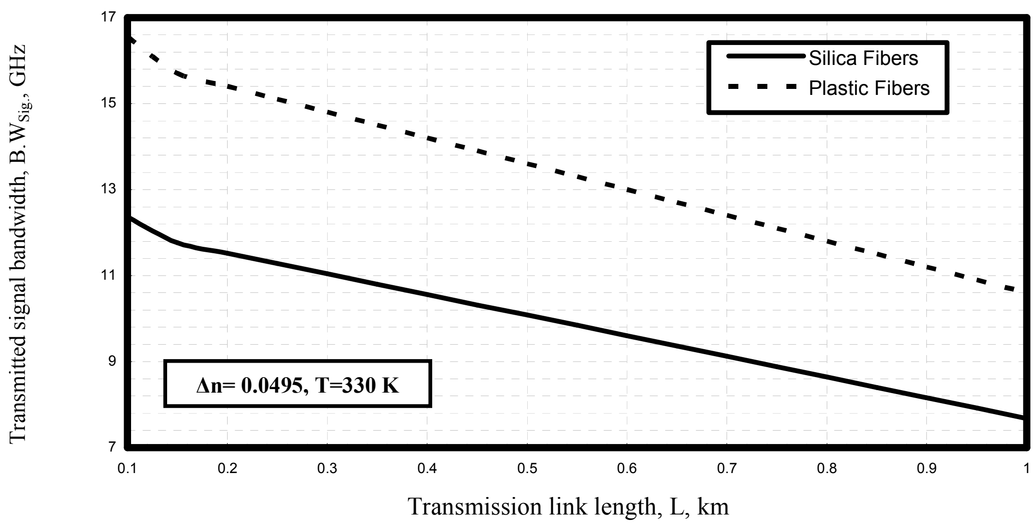

Fig. 16. Variations of transmitted signal bandwidth against transmission link length at the assumed set of parameters.

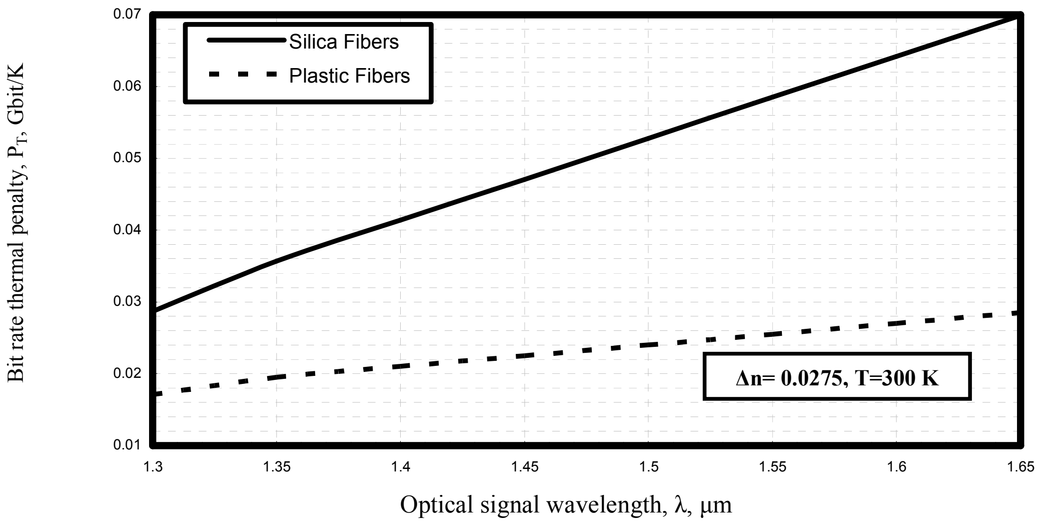

Fig. 17. Variations of the bit rate thermal penalty versus optical signal wavelength at the assumed set of parameters.

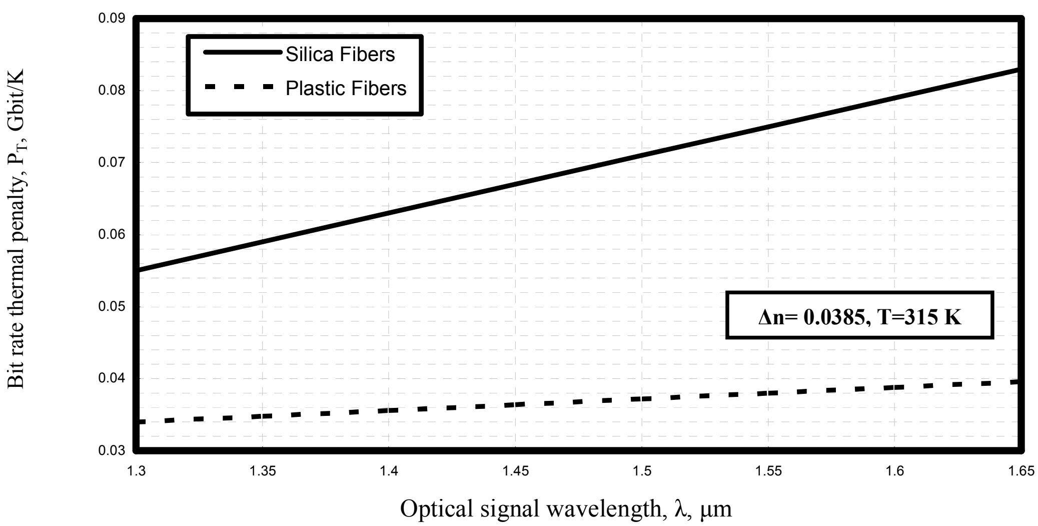

Fig. 18. Variations of the bit rate thermal penalty versus optical signal wavelength at the assumed set of parameters.

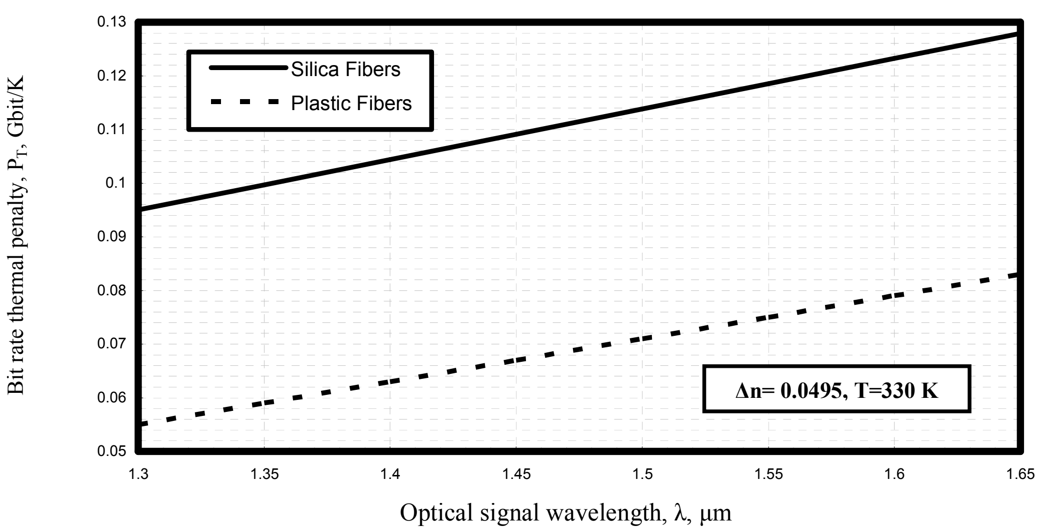

Fig. 19. Variations of the bit rate thermal penalty versus optical signal wavelength at the assumed set of parameters.

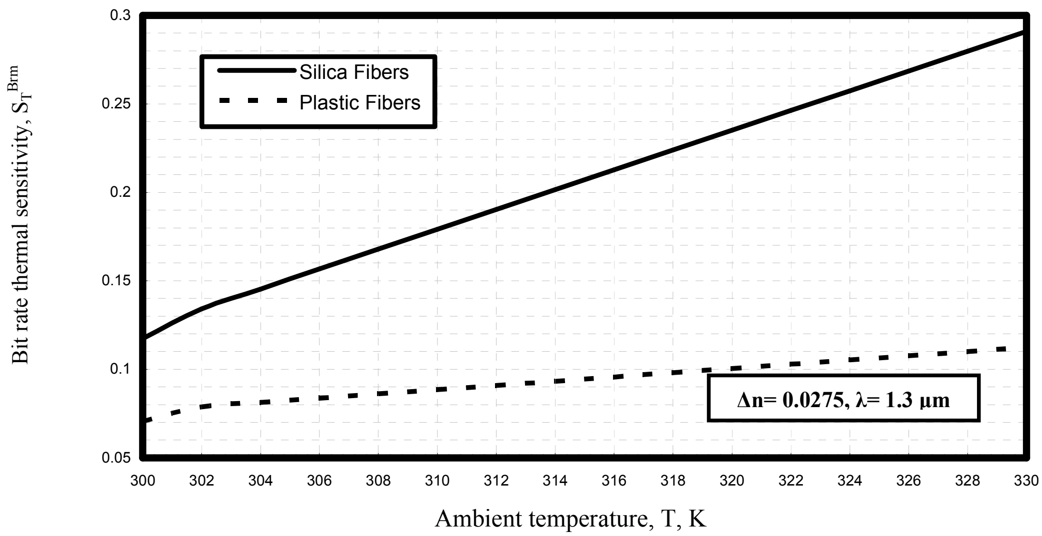

Fig. 20. Variations of bit rate thermal sensitivity versus ambient temperature at the assumed set if parameters.

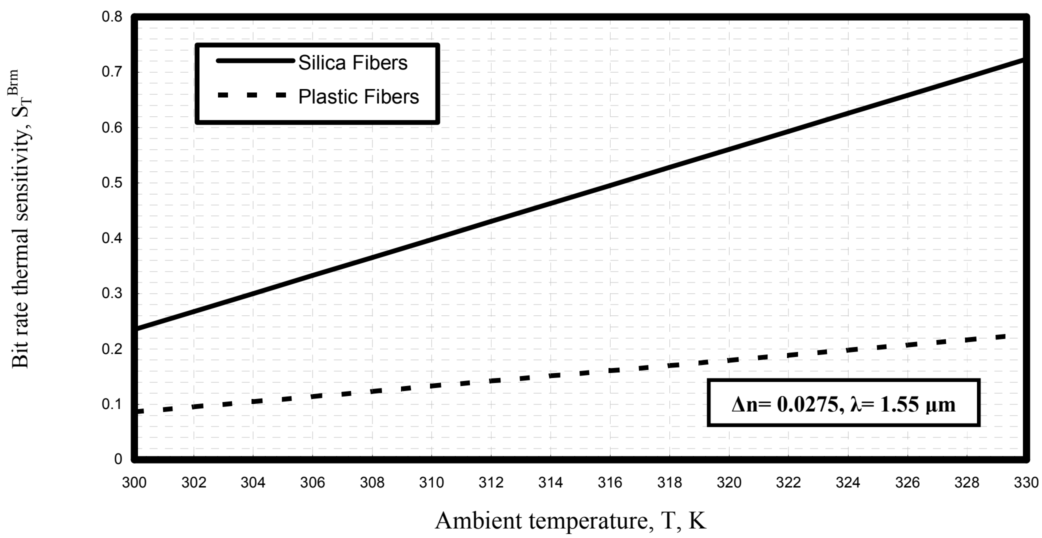

Fig. 21. Variations of bit rate thermal sensitivity versus ambient temperature at the assumed set if parameters.

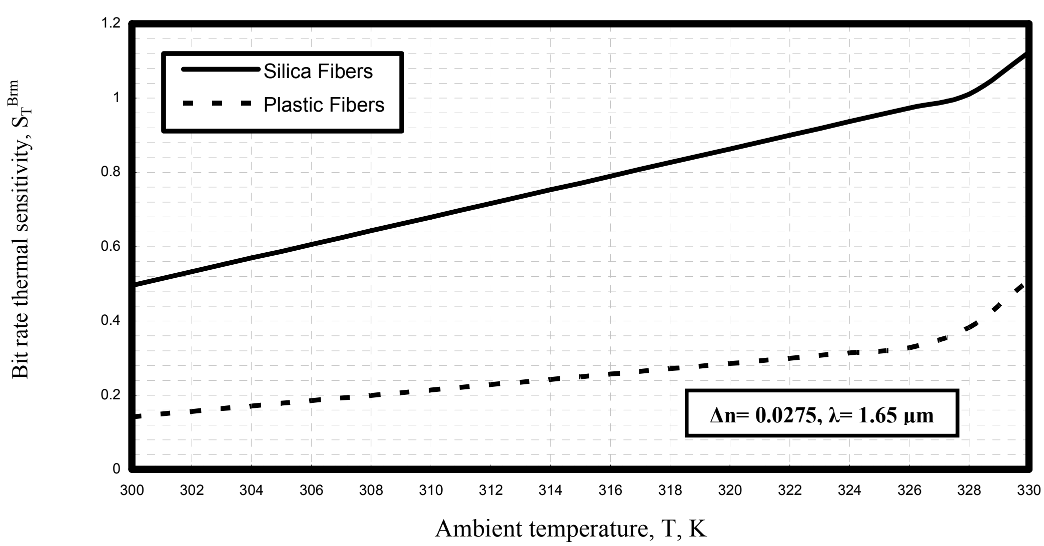

Fig. 22. Variations of bit rate thermal sensitivity versus ambient temperature at the assumed set if parameters.

IV. CONCLUSIONS

In a summary, we have presented high transmission data rates of plastic optical fibers over conventional silica fibers based optical links for short transmission applications. Plastic optical fibers can be designed on window platform so that users can design or select appropriate fiber types which are standard single mode optical fibers, dispersion shifted fibers, dispersion flatten fibers and multi layer refractive index profile fibers. It is theoretically found that the increased ambient temperature, relative refractive index difference, and transmission link length, this leads to the decreased of MTDM transmission bit rates either per link or per channel for both plastic and silica fibers. As well as the increased transmission link length, this results in the increasing of MTDM product either per link or per channel for both materials based optical links under study. But the increased of both ambient temperature and relative refractive index difference, this leads to the decreased of MTDM product either per link or per channel for both materials based optical links under study. It is evident that the increased of ambient temperature, transmission link length, and relative refractive index difference, this results in decreasing of transmitted signal bandwidth for both silica and plastic fibers. Moreover the increased operating optical signal wavelength, ambient temperature, and relative refractive index difference, this leads to the increased of bit rate thermal penalty for both silica and plastic fibers. It is also indicated that ambient temperature, relative refractive index difference and operating optical signal wavelength, this results in the increased bit rate thermal sensitivity for both materials based optical links under study. It is theoretically found that plastic optical fibers have presented higher MTDM transmission bit rates, products, and transmitted signal bandwidth. As well as plastic optical fibers have presented lower bit rate thermal penalty and bit rate thermal sensitivity compared to silica fibers at the same conditions of operating parameters.

REFERENCES

[1] M. Hossen, M. Asaduzzaman, and G. C. Sarkar, "Analysis of Dispersion of Single Mode Optical Fiber," National Conference on Communication and Information Security , pp. 143-146, NCCIS 2007.

[2] P. S. Andre, and A. N. Pinto, "Chromatic Dispersion Fluctuations in Optical Fibers Due to Temperature and its Effects in High Speed Optical Communication Systems," Optics Communications Vol. 24, No. 6, pp. 303–311, 2005.

[3] M. Kovacevica, and A. Djordjevichb, "Temperature Dependence Analysis of Mode Dispersion in Step-Index Polymer Optical Fibers," Vol. 16, No. 4, pp. 649-651, Proceedings of the International School and Conference on Photonics 2009.

[4] L. N. Binh, L. H. Binh, and V. T. Tu, "Routing and Wavelength Assignment and Survivability of Optical Channels in Ultra-high Speed IP over DWDM Networks Under Constraints of Residual Dispersion and Nonlinear Effects," IJCSNS International Journal of Computer Science and Network Security, VOL. 9, No. 2, pp. 49-60, Feb. 2009.

[5] R. Randy, "Performance of Multiclad Scintillating And Waveguide Optical Fibers Readout With Visible Light Photon Counters" pp. 78-94, Proc. SPIE 2007.

[6] A. Ghatak and K. Thyagarajan, "Introduction to Fiber Optics." Cambridge Univ. Press, 2008.

[7] H. Y. Choi, Paul K. J. Park, and Y. C. Chung," Chromatic Dispersion Monitoring Technique Using Pilot Tone Carried by Broadband Light Source," IEEE Photonics Technology Letters, Vol. 21, No. 9, pp. 578-580, May 2009.

[8] A. Sangeetha , S. K. Sudheer, and K. Anusudha, "Performance Analysis of NRZ, RZ, and Chirped RZ Transmission Formats in Dispersion Managed 10 Gbps Long Haul WDM Light Wave Systems," International Journal of Recent Trends in Engineering, Vol. 1, No. 4, pp. 103-105, May 2009.

[9] O. L. Ladouceur, H. Wang, A. S. Garg, and K. Bergman, "Low Power, Transparent Optical Network Interface for High Bandwidth Off Chip Interconnects," Optics Express, Vol. 17, No. 8, pp. 6550-6561, April 2009.

[10] A. S. Samra, and H. A. M. Harb, "Multi-layer Fiber for Dispersion Compensating And Wide Band Amplification," UbiCC Journal, Vol. 4, No. 3, pp. 807-812, August 2009.

[11] A. M. Rocha, B. Neto, M. Faveo, and P. S. Andre, "Low Cost Incoherent Pump Solution for Raman Fiber Amplifier," Optica Applicata, Vol. XXXIX, No. 2, pp. 287-293, 2009.

[12] M. S. Ab-Rahman, H. Guna, M. H. Harun, S. D. Zan and K. Jumari, "Cost-Effective Fabrication of Self-Made 1x12 Polymer Optical Fiber-Based Optical Splitters for Automotive Application," American J. of Engineering and Applied Sciences, Vol. 2, No. 2, pp. 252-259, 2009.

[13] W. Fleming, "Dispersion in GeO_2-SiO_2 Glasses," Applied Optics, Vol. 23, No. 24, pp. 4486-4493, 1984.

[14] L. N. Binh and L. H. Binh, " Transport of Assigned Wavelength Channels Over Ultra-high Speed Ethernet All-Optical DWDM Networks Under Constraints of Fiber Chromatic and Polarization Mode Dispersion Effects," JCSNS International Journal of Computer Science and Network Security, VOL. 9 No. 8, pp. 27-37, August 2009.

[15] Mohamed M. E. El-Halawany, "Sensitivities Dependence on Laser Pulses Soliton Propagation under Pure and Sea Waters" International Journal of Computer Science and Telecommunications (IJCST), Vol. 2, No. 1, pp. 1-9, March 2011.

[16] H. Murofushi, "Low Loss Perfluorinated POF," in Proc. Fifth International Conference on PLAstic Optical Fibers and Applications-POF'96, Paris (France), pp.17-23, 1996.

[17] Abd El-Naser A. Mohammed, Mohamed El-Halawany, Ahmed Nabih Zaki Rashed, and Mohamoud M. Eid "Optical Add Drop Multiplexers with UW-DWDM Technique in Metro Optical Access Communication Networks" International Journal of Computer Science and Telecommunications, Vol. 2, No. 2, pp. 5-13, April 2011.

[18] Abd El-Naser A. Mohammed, Mohamed M. E. El-Halawany, Ahmed Nabih Zaki Rashed, and Sakr Hanafy "High Performance of Plastic Optical Fibers within Conventional Amplification Technique in Advanced Local Area Optical Communication Networks " International Journal of Multidisciplinary Sciences and Engineering (IJMSE), Vol. 2, No. 2, pp. 34-42, May 2011.

[19] Abd El-Naser A. Mohammed, Abd El-Fattah A. Saad, Ahmed Nabih Zaki Rashed, and Hazem Hageen "Low Performance Characteristics of Optical Laser Diode Sources Based on NRZ Coding Formats under Thermal Irradiated Environments" International Journal of Computer Science and Telecommunications, Vol. 2, No. 2, pp. 20-30, April 2011.

[20] Mohamed A. metawe'e, "Ultra Wide Arrayed Waveguide Grating (AWG) Devices for Dense Wavelength Division Multiplexing Optical Communication Systems" International Journal of Computer Science and , Vol. 2, No. 2, pp. 38-44, April 2011.

[21] Abd El-Naser A. Mohammed, Mohamed M. E. El-Halawany, Ahmed Nabih Zaki Rashed, and Mohammed S. F. Tabour "High Transmission Performance of Radio over Fiber Systems over Traditional Optical Fiber Communication Systems Using Different Coding Formats for Long Haul" International Journal of Computer Science and Telecommunications, Vol. 2, No. 3, pp. 29-42, June 2011.

[22] Abd El-Naser A. Mohammed, Abd El-Fattah A. Saad, and Ahmed Nabih Zaki Rashed, "Spectral Sensitivity Coefficients (SSCs) of the Based Materials for Photonic Devices Under Optical Wavelength and Temperature Sensing Variations in Modern Optical Access Networks," International Journal of Library and Information Science, Vol. 1, No. 4, pp. 43-54, Sep. 2009.

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