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Cooling-Rate Induced Fiber Birefringence Variation in Regenerated High Birefringent Fiber

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Abstract : In this paper, we have reported birefringence manipulation in regenerated high-birefringent fiber Bragg grating (RPMG) by using CO2 laser annealing method. The results indicate that the birefringence of RPMG remains unchanged after CO2 laser annealing followed by a slow cooling process, but reduced after the fast cooling process (~5.6×10-5). After a series of annealing procedures with different cooling rates, the obtained results show that slower the cooling rate, higher the birefringence of RPMG. The volume, thermal expansion coefficient (TEC) and glass transition temperature (Tg) change of stress applying part in RPMG during the cooling process are responsible for the birefringence change. Therefore, these findings are important to the RPMG sensor in high and dynamic temperature environment. The measuring accuracy, range and sensitivity of RPMG sensor are greatly affected by its birefringence value. This work also opens up a new application of CO2 laser for fiber annealing and birefringence modification.

Keywords : birefringence, CO2 laser annealing, regenerated gratings, thermal stress
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