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## 6. Conclusion

In this paper, we explore the capability of the photopolymerizable glass to be applied in spectral manipulation of femtosecond laser pulses. For this purpose, we used VPHGs with both, wide and narrow bandwidth operations. Diffraction efficiency as well as spectral composition of the diffracted beams were analyzed for femtosecond laser pulses illumination centered at 800 nm and 400 nm, respectively. Gratings with high diffraction efficiency and high performance were implemented, showing the versatility of the photopolymerizable glass that can be exploited to design diffractive elements for temporal and spatial pulse shaping, as well as for the generation of variable spectral filters with tailored desired bandwidth operation.

We have performed experiments to determine the femtosecond laser induce damage threshold of the VPHGs implemented in the photopolymerizable glass. We have shown that the holographic material remain unaltered after more than 10 million Gaussian-shaped 50 fs pulses at 1 KHz repetition rate with a spatial FWHM of 2mm centered at 800nm and with 0.6mJ per pulse. LIDT occurs for values up to  $0.75 \text{ TW/cm}^2$  indicating an excellent damage threshold. This holographic material is promising for intense-fields excitations. Meanwhile, we developed a theoretical model that takes into account the grating bandwidth operability together with the spectral bandwidth of the incoming ultrashort pulses. This model interprets the main features of the diffracted beams by VPHGs with wide and narrow spectral bandwidths. It was shown that the model fits satisfactorily the spectral composition of the diffracted pulses and the total diffraction efficiency as a function of the incidence angle, as well. We also found a suitable relation between the Klein-Cook parameter  $Q$  and the grating bandwidth operation (Eq. (7)) which has been used to design gratings to perform the spectral pulse shaping. As the main Kogelnik's hypotheses hold in the whole excitation range, undesired effects limiting the holographic performance seems to be negligible in this material up to fluencies close to the damage threshold.

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