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Title:Design of a contact grating setup for mJ-energy THz pulse generation by optical rectification

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Abstract:According to the recent calculations, more efficient THz pulse generation is possible using relief grating on the front surface of the generating LiNbO₃ (LN) crystal for tilted-pulse-front-excitation rather than imaging the pump spot on a reflection grating into the LN crystal. Very recently, it was shown that-compared to a freestanding LN surface-relief grating-significantly higher diffraction efficiency can be reached if the grating profiles are filled with fused silica. Since realisation of such a setup is technically very challenging, in the present paper, we analyse the case where the input side of the LN grating is immersed into a refractive index matching liquid (RIML) instead of a solid material. Our results showed that the diffraction efficiency remains above 90 % for a refractive index ranging 1.45-1.60 of the applied RIML, and it is as high as 99 % for using the RIML for BK7. For this case, we carried out detailed calculations for various grating parameters. We propose a practical setup applying tilted input and slightly tilted output surfaces resulting in low losses and high diffraction efficiency for the pump. We conclude that a contact grating setup using BK7 RIML is suitable for producing THz pulses even in the mJ-energy range. © Springer-Verlag 2012.

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