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Amplitude and phase gratings based on spatially modulated densities of optically generated polarons in thermally reduced $LiNbO_3$[1] HAUKE BRUENING, MIRCO IMLAU, University of Osnabrueck, Germany — In thermally reduced, nominally pure $LiNbO_3$ a variety of small polarons can be observed, being responsible for the distinct photochromic properties of this material. In this contribution we use a spatially modulated excitation of polarons for the recording of holographic gratings. These gratings inherit some of the pronounced features of the polarons like a stretched-exponential relaxation behavior with a lifetime in the ms-range. Beside amplitude gratings we also find phase gratings leading to a high diffraction efficiency in some recording and readout geometries. The origin of these phase gratings can't be explained by the classic photorefractive effect due to Fe_{Li} or other photorefractive dopants. In contrast, our findings are discussed in the frame of a model taking into account a local change of the refractive index by the polaronic distortion of the crystal lattice. Measurements of activation energies also indicate that these gratings can be attributed to the small bound (Nb_{Li}^{4+})-polaron.

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