2.4 Strong Ultraviolet Induced Absorption and Absorption Gratings in $BaTiO_3$

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It is known that the optical properties of oxide crystals, such as $BaTiO_3$, $LiNbO_3$ and $KNbO_3$, are strongly influenced by the presence of impurity levels in the bandgap of the material. In terms of the photorefractive effect, the distribution and population of these levels have been the focus of much recent research into the tailoring of materials to respond to near infrared wavelengths compatible with compact solid-state laser diodes. An efficient charge transfer mechanism is based on two basic requirements: the existence of a high number density of traps at an appropriate energy level to allow photoexcitation to occur at the desired wavelength and, secondly, these traps must have a sufficiently high occupation to provide significant absorption at that wavelength. The first of these requirements can be satisfied by impurity inclusion while the second requirement may be achieved by optical illumination for example with low power ultraviolet (UV) light. Even at moderate cw UV intensities the process of the filling of these traps is fast due to the efficient interband photoexcitation. The absorption at longer wavelengths, arising from photoexcitation from these impurity levels, is therefore enhanced by this charge transfer process. The experimental observations have been explained in terms of a simple model involving interband charge transfer and a single effective impurity level. Fast formation of absorption gratings for the visible wavelength has also been demonstrated using this effect.