PHYSICAL REVIEW B (/PRB/)
covering condensed matter and materials physics

Identification of the specific Fe centers and associated defect structure responsible for enhanced dynamic holography in photorefractive $\mathrm{KNb\,O_3:Fe}$

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ABSTRACT

AUTHORS

ARTICLE TEXT

INTRODUCTION

EXPERIMENTAL

RESULTS

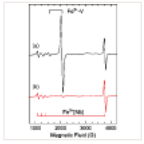
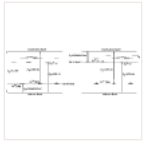
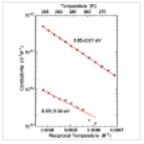
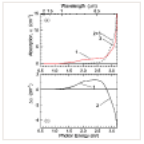
CONCLUSIONS

ACKNOWLEDGMENTS

REFERENCES

ABSTRACT

A multifaceted approach is used to identify the Fe centers associated with $\mathrm{KNb\,O_3:Fe}$, determine the location of energy levels, and conclude which centers play a vital role in the photorefractive effect; with such an understanding, the physical parameters may be modified to provide mature materials for dynamic holographic applications. A correlated study is performed on as-grown and reduced $\mathrm{KNb\,O_3:Fe}$ crystals, where a uniform reduction is achieved through a modified electroreduction process. This investigation identifies which Fe centers are reduced and which are unaffected, allowing the existence of both charge donors and acceptors as required for photorefraction, resulting in significant improvements of the photorefractive properties. Available charge transitions as a function of photon energy are identified and associated with conditions necessary for major improvements in beam-coupling efficiencies and response times. The understanding of the dynamics and defect structure is supported by photorefractive beam-coupling data. A revised explanation of the photorefractive dynamics is given as this understanding of the defects in $\mathrm{KNb\,O_3:Fe}$ is no longer described by the commonly used standard model. This new fundamental understanding that enables the development of improved materials for dynamic holographic applications may also be transferred to other materials classes for disparate applications.

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Issue

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