Photoinduced EPR study of Sb^{2+} ions in photorefractive $Sn_2P_2S_6$ crystals

A. T. Brant, L. E. Halliburton, S. A. Basun, A. A. Grabar, S. G. Odoulov, A. Shumelyuk, N. C. Giles, and D. R. Evans
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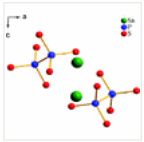
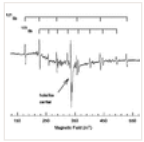
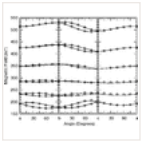
ABSTRACT

Single crystals of $Sn_2P_2S_6$ are both ferroelectric and photorefractive. Antimony (Sb) ions are optically active in this material and play an important role in optimizing the photorefractive response. Electron paramagnetic resonance (EPR) is used to determine the site and charge states of the Sb ions in $Sn_2P_2S_6$ and to illustrate the photocharging behavior of these ions. In as-grown crystals, Sb^{3+} ions substitute for Sn^{2+} ions. A multiline EPR spectrum from Sb^{2+} ions is observed after exposing a crystal at 30 K to either 633- or 442-nm laser light. These Sb^{2+} ions are thermally stable at low temperature after the light is removed. They revert back to Sb^{3+} ions when the crystal is warmed above 250 K for a few minutes. The EPR spectrum has $S = 1/2$ and consists of well-resolved sets of hyperfine lines from ^{121}Sb and ^{123}Sb nuclei. Spin Hamiltonian parameters are obtained from the angular dependence of the spectrum (principal values are 1.810, 1.868, and 1.887 for the g matrix and 1404, 1687, and 1849 MHz for the ^{121}Sb hyperfine matrix). These parameters provide evidence that the wave function for the unpaired spin has significant p-like character and has overlap with neighboring ions.

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AUTHORS & AFFILIATIONS

A. T. Brant (/search/field/author/A%20T%20Brant)[1], L. E. Halliburton (/search/field/author/L%20E%20Halliburton)[2,*], S. A. Basun (/search/field/author/S%20A%20Basun)[3,4], A. A. Grabar (/search/field/author/A%20A%20Grabar)[5], S. G. Odoulov (/search/field/author/S%20G%20Odoulov)[6], A. Shumelyuk (/search/field/author/A%20Shumelyuk)[6], N. C. Giles (/search/field/author/N%20C%20Giles)[1], and D. R. Evans (/search/field/author/D%20R%20Evans)[4]

[1]Department of Engineering Physics, Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio 45433, USA
[2]Department of Physics, West Virginia University, Morgantown, West Virginia 26506, USA
[3]Azimuth Corporation, 4134 Linden Avenue, Suite 300, Dayton, Ohio 45431, USA
[4]Air Force Research Laboratory, Materials and Manufacturing Directorate, Wright-Patterson Air Force Base, Ohio 45433, USA
[5]Institute of Solid State Physics and Chemistry, Uzhgorod National University, 88 000 Uzhgorod, Ukraine
[6]Institute of Physics, National Academy of Sciences, 03 650 Kiev, Ukraine

[*]Corresponding author: larry.halliburton@mail.wvu.edu

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