Home > Physical Sciences > Condensed Matter Physics > Quasip Article Intrinsic small polarons (Sn3+ ions) in photorefractive Sn2P2S6 cr April 2013 · Journal of Physics Condensed Matter 25(20):205501 DOI:10.1088/0953-8984/25/20/205501 Source · PubMed Authors: A.T. Brant	
A. I. Brant L Halliburton L Show all 6 authors Request full-text Download citation (i) To read the full-text of this research, you can request a copy Citations (10) References (20)	Copy link
Abstract Unique holelike small polarons are produced at divalent cation sites by optical excitation at low temperature in single crystals of Sn2P2S6, a monoclinic ferroelectric and photorefractive material. Electron paramagnetic resonance (EPR) is used to observe these self-trapped holes. During an illumination near 25 K with either 442 or 633 nm laser light, photoexcited holes become localized at Sn(2+) (5s(2)) ions and form paramagnetic Sn(3+) (5s(1)) ions. The Sn(3+) ions are thermally stable below 50 K. The principal values of the g matrix are 2.0031, 2.0176, and 2.0273 and the principal values of the (119)Sn hyperfine matrix are 12.828, 12.886, and 13.060 GHz. The large interaction with the (119)Sn (and (117)Sn) nucleus results in a highly asymmetric hyperfine pattern in the EPR spectrum. Weaker hyperfine interactions with two neighboring Sn ions are also observed.	Discover the world's research • 20+ million members • 135+ million publications • 700k+ Join for free
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ons (10)	References (20)	
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inv ide ob 3þ aft an 1⁄4	Either way, it is useful to compare the present result to a recent restigation of the stability of Sn 3b sites in SPS, which have been antified as small polarons formed by holes. 28 Reference 28 served that the electron paramagnetic resonance signal from Sn disappears near 47 K when raising the temperature of the sample er illumination. 28 They then used this temperature in the Randall d Wilkins approximation, 29 which derives an excitation energy E 25k B T max from the temperature T max where the peak in ninescence is observed while heating a sample	
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res ter de T i sa "si 30	mperature in the Randall and Wilkins approximation, 29 which rives an excitation energy E ¼ 25k B T max from the temperature max where the peak in luminescence is observed while heating a mple. The resulting activation energy obtained in this way was ightly less than 100 meV," 28 not too far from the energy range of -80 meV that we observed from our measurements al determination of the charge carrier mobility in Sn2P2S6	

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... The investigation of Sn 2 P 2 S 6 -type crystals is also important from the practical point of view because of the attractive photorefractive, acousto-optic and electrooptic properties which make them a prospective material for optical applications [15][16][17] [18] [19] . Moreover, a considerable piezoeffect has been found [20].

Dielectric, pyroelectric and ferroelectric properties of lead-doped Sn 2

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Ilona Zamaraite · Sarunas Svirskas · Yulian Vysochanskii · A. Dziaugys

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... Also, EPR has shown that isolated Sn 2+ vacancies trap a hole during illumination at low temperatures [14]. Other defects in SPS identified by EPR include sulfur vacancies [15] and Sn 3+ holelike small polarons [16]

Dual role of Sb ions as electron traps and hole traps in photorefractive Sn_2P_2S_6 crystals

Article

Dec 2016

B. E. Kananen · Eric Golden · S. A. Basun · Larry E. Halliburton

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 \ldots 30,31 The trapped-hole center is the intrinsic small polaron (Sn 3b ions) at Sn 2b sites. 32 In this paper, we focus on native defects in nominally undoped SPS crystals, and in particular, on Sn vacancies. The Sn vacancies are a shallow acceptor in SPS and thus provide an important trap for holes when gratings are written in photorefractive experiments. ...

Sn vacancies in photorefractive Sn2P2S6 crystals: An electron paramagnetic resonance study of an optically active hole trap

Article

Oct 2016 · J APPL PHYS

Eric Golden · S. A. Basun · D. R. Evans · Larry E. Halliburton

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... Unpaired electrons associated with either Ag 0 or Ag 2+ can be identified in the EPR spectra by the doublets resulting from the hyperfine interaction with the 107 Ag (nuclear spin I = 1/2, 51.8% abundant) and 109 Ag (I = 1/2, 48.2% abundant) nuclei. As documented in the literature, large nuclear hyperfine splitting is generally observed for atomic Ag [33,34] and small Ag n m+ (m b n) clusters [35, 36]. In addition, any EPR signals belonging to Sn 3+ ions can be identified by satellite lines arising from nuclear hyperfine coupling with the spin-1/2 nuclear isotopes 117 Sn and 119 Sn (natural abundances of 7.6% and 8.6%) which have been observed for Sn 3+ ions in inorganic matrices [37]. ...

Electron Paramagnetic Resonance (EPR) studies on the photo-thermo ionization process of photo-thermo-refractive glasses

Article

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Photoinduced trapping of charge at sulfur vacancies and copper ions in photorefractive Sn 2 P 2 S 6 crystals

Article

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7/30/2021

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Photoinduced EPR study of Sb2+ ions in photorefractive Sn2P2S6 crystals

October 2012 · Physical review. B, Condensed matter

A. T. Brant · Larry E. Halliburton · S. A. Basun · [...] · D. R. Evans

Single crystals of Sn2P2S6 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 Sn2P2S6 and to illustrate the photocharging behavior of these ions. In as-grown crystals, Sb3+ ... [Show full abstract]

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Article

Electron paramagnetic resonance studies of X-irradiated KH 2AsO4, KD2AsO4, RbH 2AsO4, RbD2AsO4, CsH...

November 1972 · The Journal of Chemical Physics

N. S. Dalal · J. R. Dickinson · C. A. McDowell

Electron paramagnetic resonance (EPR) studies of defect centers produced by x or Γ irradiation of the hydrogen-bonded ferroelectrics KH2AsO4, KD2AsO4, RbH2AsO4, RbD2AsO4, and CsH2AsO4 and of the antiferroelectrics NH4H2AsO4 and ND4D2AsO4, are presented. The spectra, observed over 300–4.2°K, are characterized by a very large hyperfine interaction of the unpaired electron with the 75As (I=32) ... [Show full abstract]

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