Hydrogen states in hydrogen-passivated semiconducting barium disilicide measured via muon spin rotation

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Abstract: Passivation of $BaSi_2$ films is essentially important for their use in solar cell applications. We study the effect of atomic H on photoresponsivity enhancement of 0.5 μm thick $BaSi_2$ films. A H supply duration of 15 min enhances the photoresponsivity of the $BaSi_2$ film by a factor of 10. We also investigate the electronic states of H in $BaSi_2$ via muon spin rotation. An implanted muon (μ^+) beam binds electrons to

form muonium (μ^+e^-). Their response to thermal activation shows that μ^+e^- accompanies a shallow energy level of approximately 31 meV below the conduction band minimum (CBM), indicating that atomic H also serves as an electronically active donor impurity in $BaSi_2$. This result is in good agreement with ab initio studies showing that a localized half-filled peak appears approximately 40 meV below the CBM if the first neighbors of the H atom are one Si atom and one Ba atom.

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