Excitonic Energy Shifts in Isotopically Controlled $I – III – VI_2$ Chalcopyrites: $CuGaS_2$ and $AgGaS_2$. J.S. BHOSALE, H. ALAWADHI, I. MIOTKOWSKI, A.K. RAMDAS, Purdue University, R. LAUCK, M. CARDONA, MPI for Solid State Research — $CuGaS_2$ and $AgGaS_2$ tetrahedrally co-ordinated chalcopyrites are “genealogically related” to $II – VI$ semiconductors like ZnS. We have investigated the shifts in their excitonic signatures by controlling the isotopic mass of the $I$, $III$ or $VI_2$ constituent in the crystals grown by physical vapor deposition. The excitonic signatures are observed in wavelength modulated reflectivity employing a high S/N, LED based technique. For example it reveals a 3.9 meV shift for the A exciton in $Ag^{71}GaS_2$ with respect to that of natural $AgGaS_2$; a smaller increase occurs in ZnS. These effects have been related to electron-phonon interaction caused by the zero-point vibrations. Similar effects, but with an opposite sign, have been observed for Cu-isotopes in $CuGaS_2$ as well as in the Cu-monohalides CuCl, CuBr, and CuI; their origin is receiving considerable attention at present though not yet understood. In this context the excitonic temperature dependence will be discussed.

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2J. S. Bhosale, Rev. Sci. Instrum. 82, 093103 (2011)
5Cardona, op. cit