Magneto-optical Transitions of (Ga,Mn)As

Yongmin Kim*[1], T.W. Kang[2], T. Takamasu[3] and H. Yokoi[4]

[1] Department of Applied Physics, Dankook University, Hannam-Dong, Yongsan-Gu, Seoul, Korea
[2] Quantum Functional Semiconductor Research Center, Dongguk University, Seoul, Korea
[3] National Institute for Materials Science, Tsukuba, Japan
[4] National Institute for Advanced Industrial Science and Technology, Tsukuba, Japan
*Corresponding author: e-mail: yongmin@dankook.ac.kr, Phone: +82 2 709 2403, Fax: +82 2 792 6082

Low temperature (4 K) photoluminescence measurements of a series of liquid phase epitaxy grown GaAs:Mn epilayers show distinctive donor-acceptor pair (DAP) transitions.[1] Below 0.3 % Mn molar fractions, only one broad DAP transition was observed with a corresponding phonon replica. However, exceeding 0.3 % of Mn, three peaks at 1.409 eV, 1.407 eV and 1.400 eV of DAP related transitions were observed along with their phonon echoes. In the presence of strong magnetic field, the peaks show diamagnetic energy shift and strong spin polarization. Unlike the others, the peak at 1.409 eV at zero field shows sharp feature (full-width half maximua ~ 1 meV at B=15 T) in magnetic fields and exhibits strong spin polarization. The corresponding phonon replica also shows strong spin dependency. Considering localized impurity transitions which show broad spectra, this sharp feature shown at the impurity band is not related with normal DAP and up to date, this type of transition has not been reported for III,Mn-V materials yet. We will discuss possibilities of double donor related transitions and acceptor bound magnetic polaron related transitions.

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References

[1] Th. Hartmann, M. Lampalzer,W. Stolz, K. Megges, J. Lorberth, P.J. Klar, and W. Heimbrodt, Thin Solid Films **364,** 209 (2000).