Nonequilibrium Carrier Dynamics of $Si_{1-x}Ge_x$ nanowires measured by Optical Pump-THz Probe Spectroscopy

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Abstract (Arial 10)
Optical pump THz probe spectroscopy (OPTP)[1,2] is a powerful tool to study the nonequilibrium carrier dynamics of 1D/2D materials such as nanowires, phase transition materials, graphene, etc. occurring on ultrafast time scales. The basic understanding of carrier dynamics in nanostructures on ultrashort timescale[3-5] is getting important for the design of optoelectronic devices. In case of 1D NWs, the surface effect can no longer be ignored due to its large surface to volume ratio. $Si_{1-x}Ge_x$ nanowires (NWs) were synthesized *via* a vapor-liquid-solid procedure using Au as a catalyst. The noneqilibrium carrier dynamics of $Si_{1-x}Ge_x$ NWs as a function of Ge content was measured by optical pump-THz probe spectroscopy. From the measured $\Delta T/T_0$ signal of $Si_{1-x}Ge_x$ NWs, two carrier relaxation times of τ_1 (fast) and τ_2 (slow) were obtained and the optical properties of NWs at each Ge content were investigated. Factors which affect the carrier life time were discussed in this paper. We found that OPTP spectroscopy has a great potential to study the equilibrium/nonequilibrium dynamics as well as optical properties of 1D/2D materials.

References

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Figures

Figure 1. Schematic diagram of Optical pump-THz probe spectroscopy.

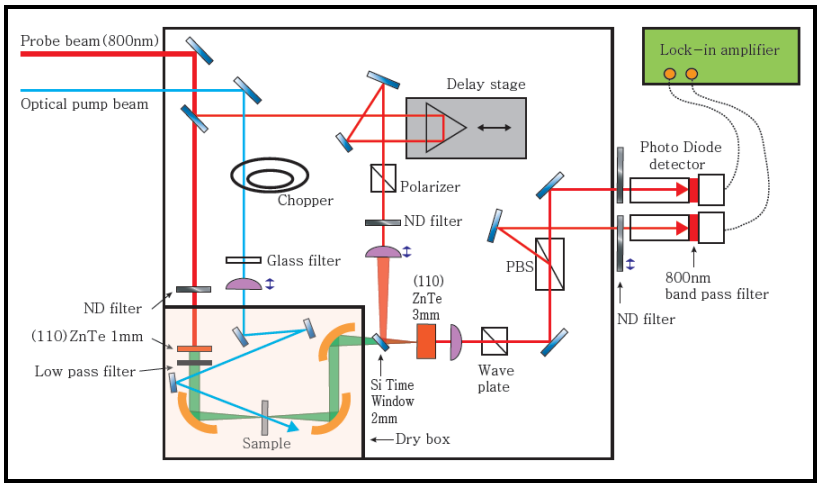

Figure 2. The measured ΔT/T0 of the $Si_{1-x}Ge_x$ NWs as a function of Ge content.