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Thermally activated persistent photoconductivity & donor binding energy in high mobility AlAs QWs S. DASGUPTA, C. KNAAK, A. FONTCUBERTA, M. BICHLER, G. ABSTREITER, Walter Schottky Institut, TU Munich, Germany, M. GRAYSON, Walter Schottky Institut and Dept. of Electrical Engineering and Computer Science, Northwestern University, USA — In AlAs, valley index is important quantum number which can help understand interactions. However, important parameters for growth such as donor binding energy and Si δ-doping efficiency were unknown and AlAs quantum wells (QWs) typically did not conduct in dark. We grew series of (001) and (110) oriented double-sided doped n-type AlAs QWs and deduced Si donor binding energy Δ in $Al_{0.45}Ga_{0.55}$ As and doping efficiency η. They work in dark possibly because dilute charge traps in substrate are screened by backside doping. From dark saturation density for doping series we deduced Δ_{dk}=65.2 meV [1]. Our studies show thermally activated PPC where sample is illuminated at 4 K and returned to dark without appreciable density increase. As temperature is increased to 30 K, density doubles, indicating shallow binding energy Δ_{PIA}=0 meV post-illumination anneal (PIA). Doping efficiency after illumination for (001) facet was found to be η=n_{2D}/n_{Si}=35% and for (110) η=17%. With this understanding, we designed (001) AlAs QW with PIA density n=2.4 x 10^{11} cm^{-2} and mobility μ=4.3 x 10^5 cm^2/Vs(330 mK), improvement of almost an order of magnitude over published results. [1] Dasgupta, *et al.* APL (2007)

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