Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Effect of large uniaxial strain on carrier recombination mechanisms in GaAs P. GRIVICKAS, M.D. MCCLUSKEY, Y.M. GUPTA, Washington State University — Carrier transport properties govern the operating characteristics of semiconductor devices. Strains are known to have a profound effect on carrier recombination processes, but details of these effects are not well understood due to the inherent limitations of common compression techniques. In this work, carrier lifetime measurements were obtained in shock-compressed GaAs using time- and spectrally-resolved photoluminescence measurements. Linear lifetime reduction was observed for different doping concentrations and for different crystal orientations. These experimental findings do not support previous hypothesis that emphasize recombination center formation in highly strained GaAs. A numerical carrier dynamics model, based on the continuity equation, was constructed to relate the experimental findings to the underlying material properties. It is shown that uniaxial strain primarily affects the non-radiative recombination mechanism and is consistent with the loss of quantum efficiency observed in GaAs. Work supported by DOE/NNSA.

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Date submitted: 15 Feb 2013 Electronic form version 1.4