Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Confined Doping for Control of Transport Properties in Nanowires and Nanofilms[1] JIANXIN ZHONG, G. MALCOLM STOCKS, Oak Ridge National Laboratory — Doping, an essential element for manipulation of electronic transport in traditional semiconductor industry, is widely expected to play important role as well in control of transport properties in nanostructures. However, traditional theory of electronic disorder predicts that doping in one-dimensional and two-dimensional systems leads to carrier localization, limiting practical applications due to poor carrier mobility. Here, a novel concept is proposed that offers the possibility to significantly increase carrier mobility by confining the distribution of dopants within a particular region [1]. Thus, the doped nanostructure becomes a coupled system comprising a doped subsystem and a perfect crystalline subsystem. We showed that carrier mobility in such a dopped nanowire or a nanofilm exhibits counterintuitive behavior in the regime of heavy doping. In particular, the larger the dopant concentration the higher the carrier mobility; we trace this transition to the existence of quasi-mobility-edges in the nanowires and mobility edges in nanofilms.

1. J.X. Zhong and G.M. Stocks, Nano Lett., in press, (2005)

[1]Supported by the Material Sciences and Engineering Division Program of the DOE Office of Science under contract DE-AC05-00OR22725 with UT-Battelle, LLC.

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Date submitted: 22 Dec 2005 Electronic form version 1.4