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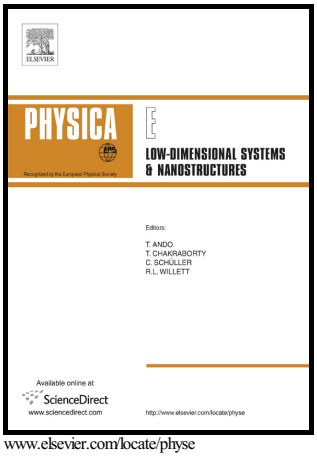

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PII: S1386-9477(16)31267-X
DOI: http://dx.doi.org/10.1016/j.physe.2017.02.013
Reference: PHYSE12732

To appear in: *Physica E: Low-dimensional Systems and Nanostructures*

Received date: 7 November 2016
Revised date: 1 February 2017
Accepted date: 15 February 2017

Cite this article as: Behnaz Sarebanha, Somaieh Ahmadi and Leila Eslami Impact of Phosphorus superlattices on charge and spin dependent transpor properties of zigzag silicene nanoribbons, *Physica E: Low-dimensional System and Nanostructures,* http://dx.doi.org/10.1016/j.physe.2017.02.013

Impact of Phosphorus superlattices on charge and spin dependent transport properties of zigzag silicene nanoribbons

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Abstract

To investigate charge and spin dependent conductance properties of Phosphorus doped zigzag silicene nanoribbons (ZSiNRs), we utilize recursive Green's function method and Landauer-Büttiker formalism. Our calculations are performed in the absence and presence of exchange magnetic fields with both parallel and antiparallel configurations. Considering a supperlattice of Phosphorus substituents in a periodic distribution at the edge of nanoribbon, the effect of increasing number of dopants and period of the distribution on transport properties are studied. It is found that transport properties of doped ZSiNRs vary with doping concentration according to being odd or even of number of dopants. For parallel configuration, doped ZSiNR with various concentrations works as a controllable spin filter with Fermi energy. Increasing doping concentration leads to increasing size of conductance gap and improvement of controlling quality of spin-filtering property while increasing period of Phosphorus atomic distribution has destructive effect on size of conductance gap and destroys spin-filtering property. Moreover, we show that although the same results are obtained for transport properties of doped ZSiNR with various concentrations of Phosphorus atoms in presence of antiparallel exchange magnetic fields, a completely controllable spin-filtering property cannot be achieved by Fermi energy changes.

Keywords: Zigzag silicene nanoribbon, Doping effect, Spin filtering, Green's function.

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