Electronic structures of silicene nanoribbons

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Silicon-based nanostructures are important because these nanostructures are compatible with conventional semiconductor industry. Nanoribbons are novel one-dimensional nanomaterials for the nanoscience and nanotechnology. We have investigated the electronic properties of silicene nanoribbons. We find that the silicene nanoribbons, which are constructed from the silicene sheet, have similar electronic and magnetic properties as the graphene nanoribbons. The armchair silicene nanoribbons can be classified into three types, which become metals or semiconductors depending on nanoribbon widths. The zigzag silicene nanoribbons have the antiferromagnetic semiconducting state as the ground state, which will be half-metals under transverse electric field. These results show silicene nanoribbons, rivaling graphene nanoribbons, have both rich electronic and magnetic properties, which can be used for silicon-based electronic and spintronic nano-devices.