Thermoelectrical properties of silicon double heterostructures with buried magnesium silicide two-dimensional structures

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The possibility of embedding of low-dimensional magnesium silicide inside silicon matrix has been shown in previous works [e-JSSN v.3; JAP v.73]. Si/Mg_2Si/Si(111) heterosystems are characterized by bigger thermoelectric power than the silicon substrates on which they are grown. By optical and Raman data the Mg_2Si nanocrystals are embedded in the polycrystalline silicon matrix with sizes of silicon crystallites less than 15 nm. But 2D Mg_2Si layer is embedded in polycrystalline silicon matrix with sizes of silicon crystallites appreciably more than 15 nm. The low-temperature conductivity through a two-dimensional magnesium silicide layer with high mobility of holes, formed inside the silicon matrix, or through the polycrystalline silicon cap layer at the expense of injection of holes from Mg_2Si nanocrystallites into silicon was firstly found. The hole injection from Mg_2Si NCs or 2D layer into silicon cap layer also results to increase of the thermoelectric power coefficient: the resistivity is lower the 5 $\Omega*$cm, the thermoelectric power coefficient is closer to 100 μV/K.