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Exchange induced electron transport in heavily n-doped Si nanowires[1] JOONYEON CHANG, Korea Institute of Science & Technology, TAE-EON PARK, Yonsei University, Korea Institute of Science & Technology, BYOUNG-CHUL MIN, Korea Institute of Science & Technology, ILSOO KIM, Yonsei University, JAE-EUN YANG, MOON-HO JO, Postech, HEON-JIN CHOI, Yonsei University, KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY TEAM, YONSEI UNIVERSITY TEAM, POSTECH TEAM — Silicon nanowires (Si NWs) have been used as building blocks in the "bottom-up" approach to nanoelectronics because of their excellent electrical properties. Despite the potential of Si NWs, unfortunately, there is little known about the electrical properties of heavily doped Si NWs. We have synthesized heavily doped n-type Si NWs and measured the electrical resistance using four-probe method. As we decrease the temperature, the resistivity of Si NWs decreases initially, shows a resistivity minimum around 60 K, and thereafter increases logarithmically. Below the resistivity minimum temperature (T_{min}), we have observed a dip around zero-bias in the differential conductance, and a negative magnetoresistance (MR) which depends on the angle between the applied magnetic field and current flow. These results are associated with the impurity band conduction and electron scattering by the localized spins at phosphorus donor states. The analysis on the MR reveals that the localized spins are coupled antiferromagnetically at low temperature via the exchange interaction.

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