Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Unconventional but tunable phase transition above the percolation threshold by two-layer conduction in electroless-deposited Au nanofeatures on silicon substrate[1] SEUNG-HOON LEE, Department of Physics, Pukyong National University, SEONGPIL HWANG, Department of Advanced Materials Chemistry, Korea University, JAW-WON JANG[2], Department of Physics, Pukyong National University — Previous research has shown that disorder, dislocation, and carrier concentration are the main factors impacting transitions in the traditional metal–insulator transition (MIT) and metal–semiconductor transition (MST). In this study, it is demonstrated that a non-traditional MST governed by two-layer conduction is possible by tuning the conducting channel of one layer of the two-layer conduction system. By means of the electroless deposition method we produced Au nanofeatures (AuNFs) on p-type silicon (p-Si) as the two-layer conduction system, controlling AuNF coverage (Au%) below and above the percolation threshold (pc). Even when the AuNF coverage percentage is larger than pc, the resistivities of the AuNFs on p-Si show MST as the temperature increases. We present a conduction model based upon two predominant parallel conductions by AuNFs and p-Si in the present paper. In the results, we show how the temperature of the MST is tuned from 145 to 232 K as Au% is changed from 82.7 to 54.3%.

[1]Supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (no. 2013K1A3A1A32035429 and 2015R1A1A1A05027681)
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Date submitted: 05 Nov 2015 Electronic form version 1.4