Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Ambipolar behavior and thermoelectric properties of WS2 nanotubes YOHEI YOMOGIDA, HIDEKI KAWAI, MITSUNARI SUGAHARA, RYOTARO OKADA, KAZUHIRO YANAGI, Tokyo Metropolitan University — WS2 nanotubes are rolled multi-walled nanotubes made by a layered material, tungsten disulfides Since the discovery by Tenne et al in 1992, various physical properties have been revealed. Theoretical studies have suggested their distinct electronic properties from those of two dimensional sheet, such as one-dimensional electronic strucutures with sharp van Hove singularities and chiralitiy depended electronic structures. Their fibril structures enable us to make their random network films, however, the films are not conducting, and thus have not been used for electronic applications. Here we demonstrate that carrier injections on the WS2 networks by an electrolyte gating approach could make the networks as a semiconducting channel. We clarified the Raman characteristics of WS2 nanotubes networks under electrolyte gating, and confirmed capability of electron and hole injections. We revealed ambipolar behaviors of the WS2 nanotube networks in field effect transistor setups with electrolyte gating. In additio, we demosntrate N-type and P-type control of thermoelectric properties of WS2 nanotubes by electrolyte gating.The power factor of the WS2 nanotubes almost approached to that of the single crystalline WS2 flakes, suggesting good potential for thermoelectric applications..

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Date submitted: 12 Nov 2016 Electronic form version 1.4