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Thermal and transport properties of a single nickel nanowire MIN-NAN OU, YANG-YUAN CHEN, MAW-KUEN WU, TZONG-JER YANG, P. C. LEE, S. R. HARUTYUNYAN, C. D. CHEN, S. J. LAI, INSTITUTE OF PHYSICS, AS, TAIWAN TEAM, DEPARTMENT OF ELECTROPHYSICS, NCTU, TAIWAN TEAM, INSTITUTE FOR PHYSICAL RESEARCH, NAS, ARMENIA COLLABORATION — Starting with a 100 nm nickel film grown on a Si_3N_4/Si substrate by thermal evaporator, a suspended nickel nanowire (Ni-NW) was fabricated through e-beam lithography and etching processes. The Ni-NW was a part of 4-probes circuit which is designed for electrical, thermal and thermopower measurements. The resistivity (ρ) and thermal conductivity (κ) of a single nickel nanowire have been measured in the temperature range from 4 to 300 K by 4-probes method and the self-heating-3ω technique. At 300 K the thermal conductivity of nanowire is $\sim 20\%$ of the bulk, it diminishes to lower value as temperature decreases, the consequence is opposite to that in the bulk in which it decreases with temperature increase. The result might be explained by the restriction of mean free paths of electron/phonon–phonon interactions due to the grain boundaries. The small relative resistivity ratio (RRR $\sim$ 2) confirms the polycrystalline characteristic of the nanowire. The thermopower (Seedbeck coefficient S) was also investigated by temperature gradient built up between two ends of the nanowire. The figure of merit ZT=$S^2\sigma/\kappa$ in the one-dimension specimen will be discussed.

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