Enhanced Electrical and Physical Properties of Metal Nanowire Networks Using Inductive Coil System

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The most populartransparent conductive film is indium tin oxide (ITO). Even though there is anissue related to the limited supply of indium, it has been used for severaldecades, and there is an urgent need for novel transparent and flexibleconductive electrodes. Metal nanowire networks are promising candidates toreplace ITO as transparent conductors among several candidates such as carbonnanotubes, graphene, metal grid, conducting polymer. Metal nanowire has lots ofadvantages, for example, inherent high electrical conductivity, transparency and can be easily fabricated by using variousmethods for the flexible substrate. Despite these advantages, AgNW has itslimitations due to its own surface roughness and adhesive problems. Also, thehigh contact resistance between AgNW from the coating of polyvinylpyrrolidone(PVP) and loose contact between individual AgNWs remains a critical issue. Inorder to overcome this problem, we constructed an inductive coil system thatgenerates eddy current and welded nanowires through the electric field for ashort time only in the junction part by the indirect heating method. We expectthe welding effect without affecting the substrate and nanowires andsimultaneously without changing the transparency of AgNWs electrode substrate. Asa result, the sheet resistance was reduced by about 67.8% without changing thetransmittance, and it was confirmed that it is applicable to various substratessuch as a flexible substrate. We also confirmed the decrease of surfaceroughness by welding of the junction. In addition, bending test and adhesivetest were conducted to confirm that the welding was effective at the junctionpart of the nanowire, thereby, improving the properties of the nanowirenetworks. It is believed that this welding method can be applied to all kind ofmetal nanowires and it can be applied to a large area through short time andlow-cost.