

Journal Name

ARTICLE

Supporting Information

Simple Hydrothermal Synthesis of Very-Long and Thin Silver Nanowires and Its Application in High Quality Transparent Electrode

*Bushra Bari, Jinhwan Lee, Taehee Jang, Phillip Won, Seung Hwan Ko, Khalid Alamgir, Muhammad Arshad, and L. Jay Guo\**

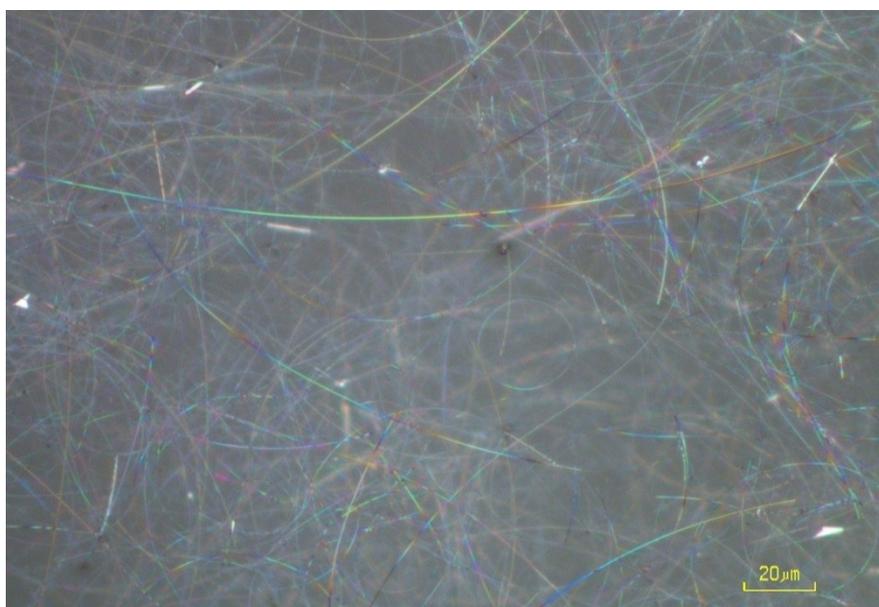


Figure S1. Microscopic image of long nanowires.

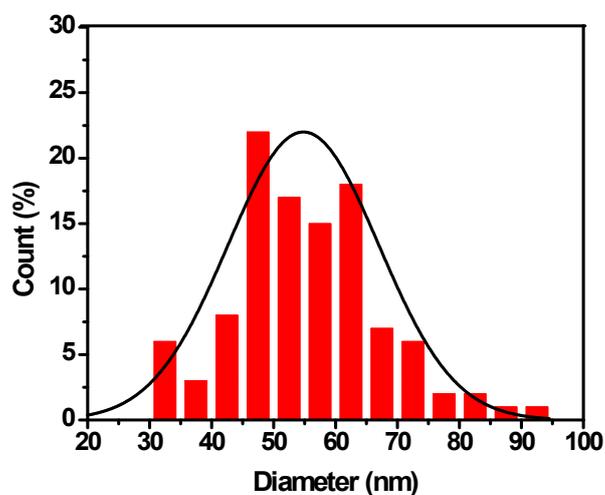
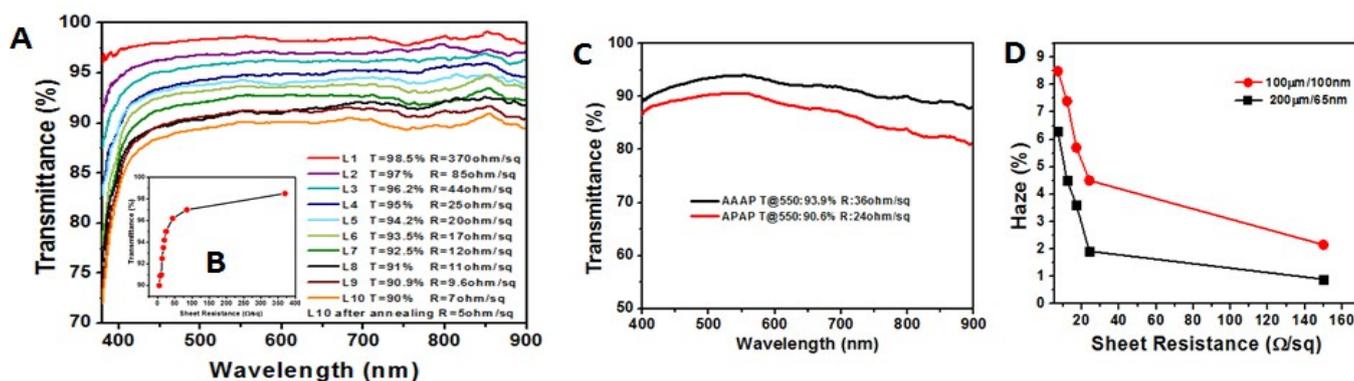
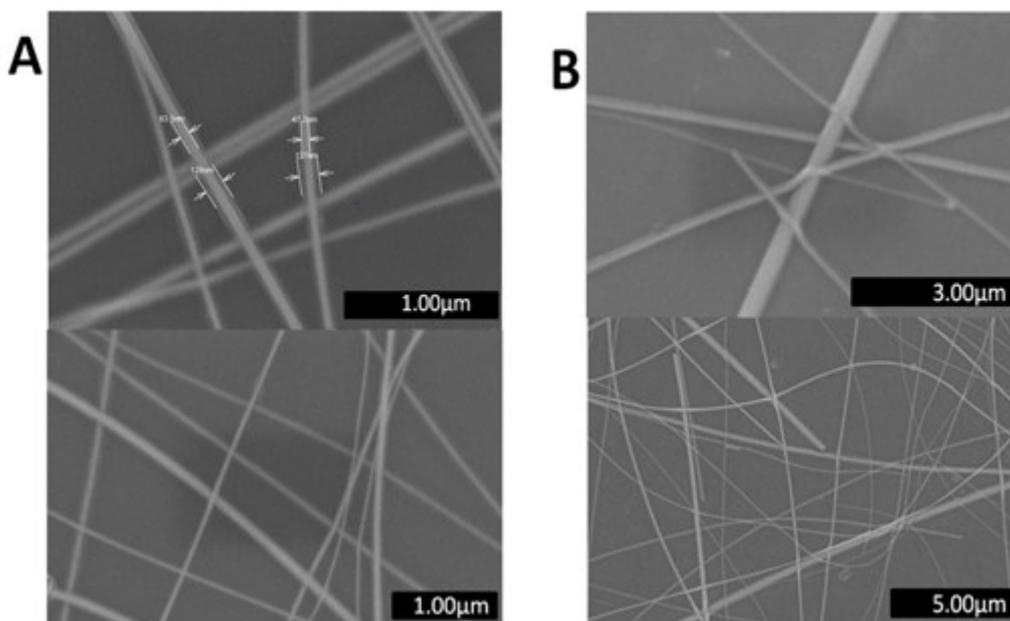


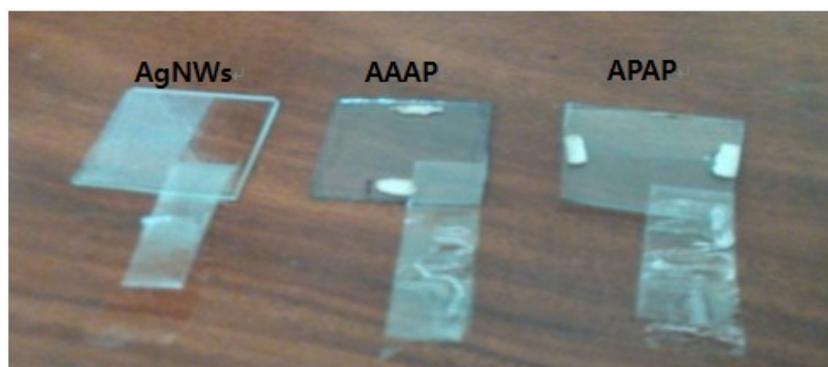
Figure S2. Diameter histogram of silver nanowires obtained by hydrothermal reaction.



**Figure S3.** (A) shows transmission of AgNW films in the visible region of the spectrum with different coverage density provided by spin coating one to ten layers of silver nanowire. The inset (B) shows the relationship between transmission @ 550 and the corresponding sheet resistance. Initially, as expected, it showed a rapid drop in sheet resistance as more and more nanowires were added to the network. It is clear that these long nanowires can provide 7 ohm/sq sheet resistance at 90% @ 550 nm transmission with reference to glass substrate without any post-processing method. To improve adhesion of silver nanowires with the substrate two multilayer structures were tried on glass substrates as AgNW/AgNW/AgNW/PEDOT:PSS (sample AAAP)(fig. S4 (A)) and AgNW/PEDOT:PSS/AgNW/ PEDOT:PSS (sample APAP) (Fig. S4 (B)). The transmittance of film AAAP (fig. S4 (B)) was higher than film APAP (fig. S4 (B)) as represented in fig. S3 (C), however, the SEM images clearly shows better contacts between nanowires in fig. S4 (B) in which a layer of PEDOT:PSS was applied after each AgNW layer. Fig. S3 (C) shows transmittance plot of multilayer films. Besides good adhesion and decrease in the surface roughness, PEDOT:PSS possesses a blue tinge that affects the transparency of the electrode. (D) Show lower than 1% haze using synthesized AgNWs at 150 ohm/sq sheet resistance (Black solid line, 0.89%).



**Figure S4.** SEM images of AgNWs/PEDOT:PSS multilayer electrodes (A) AgNW/AgNW/AgNW/PEDOT:PSS (B) AgNW/PEDOT:PSS/AgNW/PEDOT:PSS.



**Figure S5.** Adhesion strength comparison by tape peel off test (Bare AgNW on glass, AgNW/AgNW/AgNW/PEDOT:PSS on glass, AgNW/PEDOT:PSS/AgNW/PEDOT:PSS on glass)

**Table S1:** Sheet resistance values of few AgNW/PEDOT:PSS multilayer samples without annealing.

Sample	Layer	Sheet resistance
1-AAAP	AgNW	243Ω/sq
	AgNW	111Ω/sq
	AgNW	55Ω/sq
	PEDOT:PSS	36Ω/sq
2-AAAP	AgNW	394Ω/sq
	AgNW	134Ω/sq
	AgNW	78Ω/sq
	PEDOT:PSS	41Ω/sq
1-APAP	AgNW	338Ω/sq
	PEDOT:PSS	146Ω/sq
	AgNW	51Ω/sq
	PEDOT:PSS	24Ω/sq
2-APAP	AgNW	490Ω/sq
	PEDOT:PSS	180Ω/sq
	AgNW	76Ω/sq
	PEDOT:PSS	29Ω/sq

**Table S2:** % Conversion of Ag<sup>+</sup> to Ag

Mass of Ag ions (mg)	31.8
Mass of product (Ag nanowires + particles) (mg)	23.1
Conversion of Ag <sup>+</sup> to Ag (%)	72.7
Percentage of Ag nanowires in product (%)	> 90
Mass of AgNWs	>20.79