

Electronic Supplementary Information:

Inkjet-printed Ag electrodes on paper for high sensitivity impedance measurements

Hanbin Ma^a, Yang Su^a, Chen Jiang^a and Arokia Nathan^{a*}

^aDepartment of Engineering, Electrical Engineering Division, University of Cambridge

* To whom correspondence should be addressed:

Tel: +44 (0) 1223 748302

Fax: +44 (0) 1223 748322

E-mail: an299@cam.ac.uk

ESI Table 1. Concentrations of NaCl solution used for measurements and their electrical properties

NaCl solution concentration (mg/ml)	Approx. conductivity (S/m)	Approx. relative permittivity
0.312	0.0617	80.2
0.625	0.1240	80.1
1.25	0.2480	79.8

ESI Table 2. Model extracted parameters for the impedance measurements

	Electrode	NaCl concentrations (mg/ml)		
		0.312	0.625	1.25
Solution resistance R_s (Ω)	Au	4378	2256	1150
	Non-passivated Ag	3895	2194	1208
	Passivated Ag	4185	2348	1260
Solution capacitance C_s (F)	Au	8.25e-12	8.11e-12	7.69e-12
	Nano-passivated Ag	1.28e-11	1.25e-11	1.17e-11
	Passivated Ag	1.35e-11	1.33e-11	1.26e-11

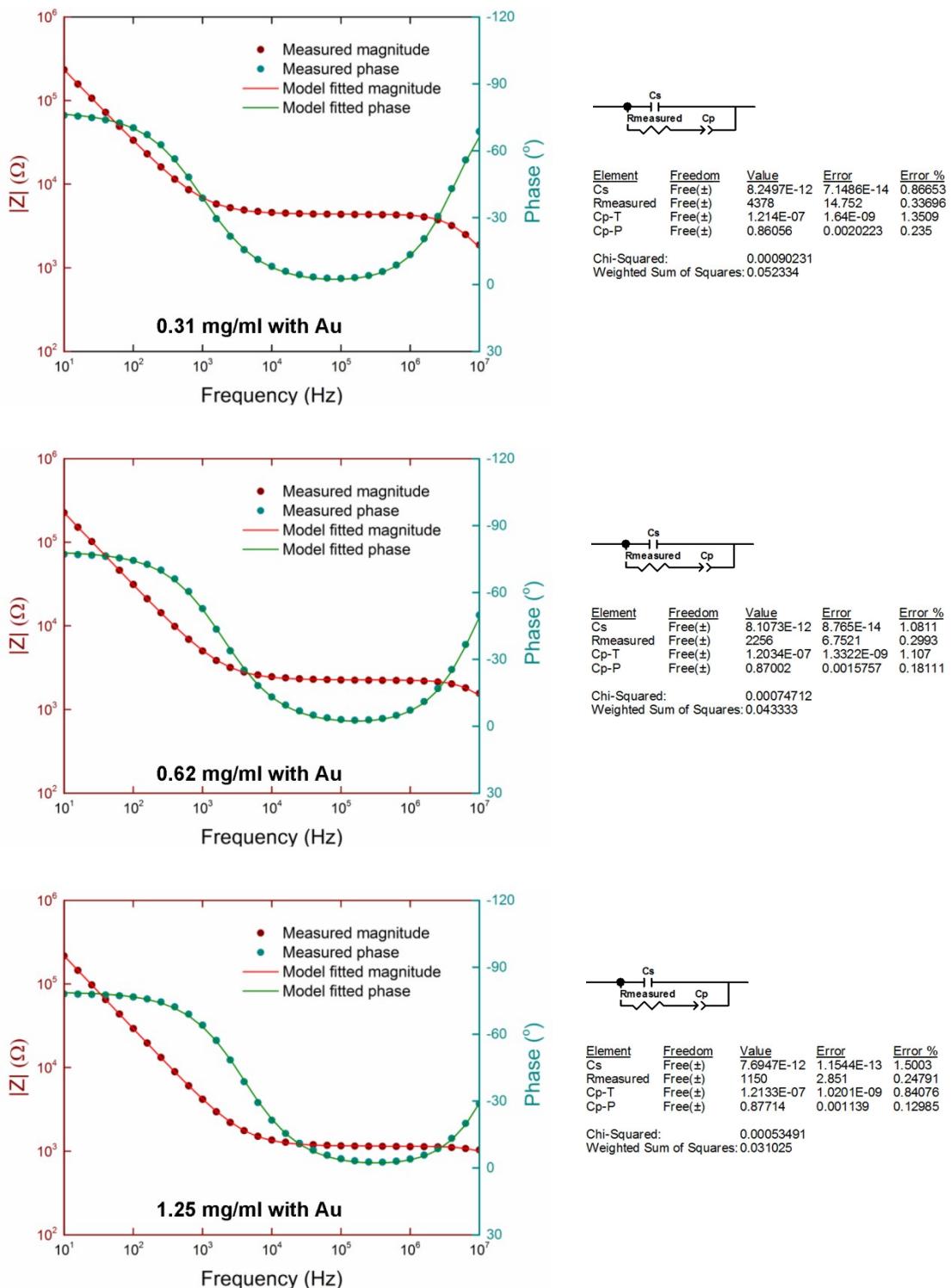
ESI: Office inkjet printer and commercial ink

In this work, an office inkjet printer (Brother MFC-J6510DW) was used. The circuit printer cartridge set which is compatible with Brother printer was directly purchased from AgIC Inc. The cartridges containing AgIC #1000 inks were designed for short-term use prototyping use. It can be printed on glossy paper directly without the need for a sintering process. The printed sheet thickness is around 135 μm and sheet resistance is 0.3 Ω/Sq . (<https://agic.cc/en#index-inks>)

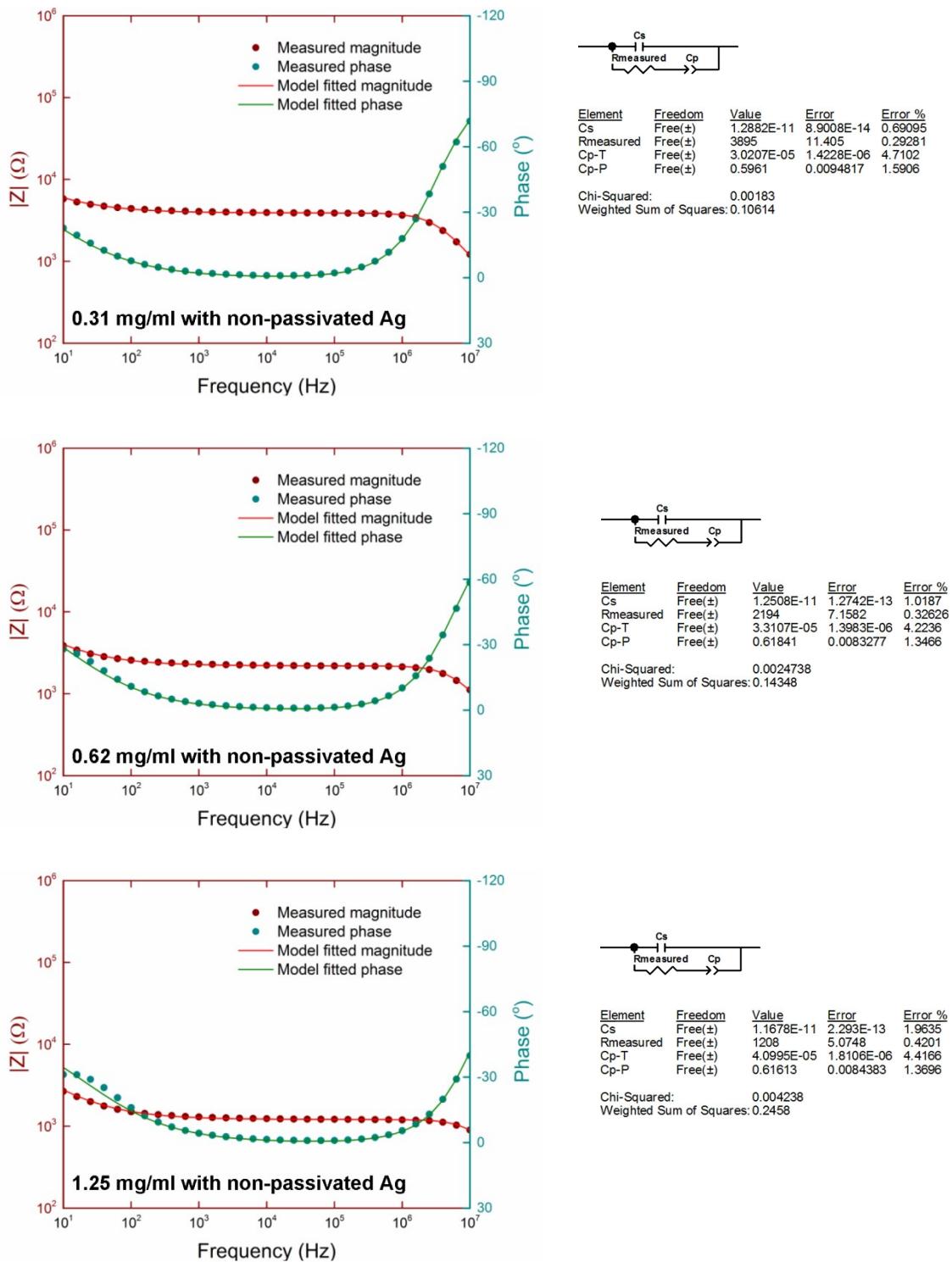
ESI: Wetting issue between paper and printed Ag electrode

The silver ink cartridge used in this work was purchased from industrial supplier (AgIC), which can be printed on glossy paper directly. Wetting issue between paper and conductive ink has been solved by the supplier. In addition, for impedance measurement, only the conductive electrode, electrode-electrolyte interface and the sample solution are involved in the measurement circuit loop. The effects from insulated paper substrate and the interface between paper and electrodes are negligible, and therefore are not mentioned and discussed in the main article.

ESI Figure 1. Model fitting results for gold electrodes with equivalent circuit as shown in Fig. 3.b



ESI Figure 2. Model fitting results for non-passivated Ag electrodes with equivalent circuit as shown in Fig. 3.b



ESI Figure 3. Model fitting results for passivated Ag electrodes with equivalent circuit as shown in Fig. 3.e

