SIMPECC

CIMPS Dummy Cell

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The SIMPECC was designed to simulate the typical dynamic behaviour of a small area dye sensitized solar cell (DSSC). Therefore it is well suited to demonstrate the advantageous features of Zahner CIMPS. The photoelectric response efficiency in real DSSC tends to zero at frequencies beyond some KHz, because the time-constants for electron recombination (lifetime) and electron diffusion rate are typically in the order of some milliseconds. This behaviour is also realized in the SIMPECC. Several important considerations have to be taken into account, when comparing the typical reference spectra attached with own tests:

1. Install the SIMPECC at the cell site without using the PECC cell carrier. Ensure the four photodiodes are facing the light source.
2. Do not use an UV- or IR-light-source, because the spectral behaviour of the photodiodes used in the dummy cell is not well defined. Use instead white - or other VIS colours.
3. Do not deviate too much from the 21°C test temperature, where the reference measurements were performed, because sensitivity, forward resistance and chemical capacity of the diodes are temperature-dependent.
4. Adjust the bias conditions for the dummy cell in a way, that for the EIS and IMPS the potentiostatic mode is set with a control voltage of zero.
5. Adjust the average intensity in a way, that the photocurrent is close to 100 µA for comparison with the "esbx" reference series and close to 300 µA for comparison with the "esbx300u" reference series. Consider that the photocurrent has dramatic influence on the shape of all spectra! A typical power of 10 W/m^2 and 30 W/m^2 is necessary to adjust 100 respectively 300 µA with a white WLL01 light source.
6. Run the EIS like usual with a sinus amplitude around 5 mV. You can go up to 1 MHz.
7. Run the IMPS with high modulation grade (about 20 to 50%) for good S/N at high frequencies. (Example: if the light-source potentiostat applies about 1V to establish 10 W/m^2, use 100-500 mV amplitude.
8. Run the IMVS with less high modulation grade (about 5 to 10%) for sufficient S/N at high frequencies and sufficient linearity at low frequency. (Example: if the light-source potentiostat applies about 1 V to establish 10 W/m^2, use 20-100 mV amplitude.
9. Use the "automatic switch to photovoltage mode" option, when going from IMPS to IMVS. This guarantees that the same bias condition is kept (all spectra at 0 V with 100 respectively 300 µA).
10. Reduce the frequency range to a maximum of 10 KHz and set the starting frequency to 100 Hz for both IMPS as well as IMVS. It makes no sense to look on a transfer function which is defined only by noise: beyond some KHz the dummy cell response is zero (like on a DSSC) and the measurement will show simply scatter and hysteresis.

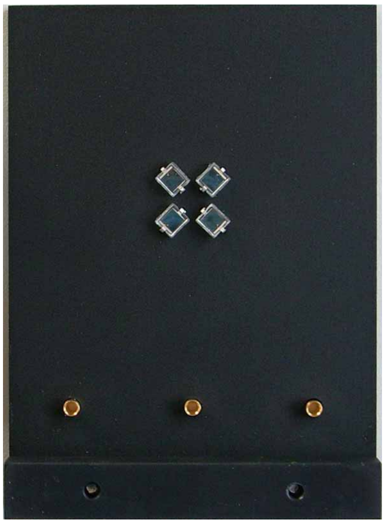

Fig. 1 SIMPECC front side facing the light source.

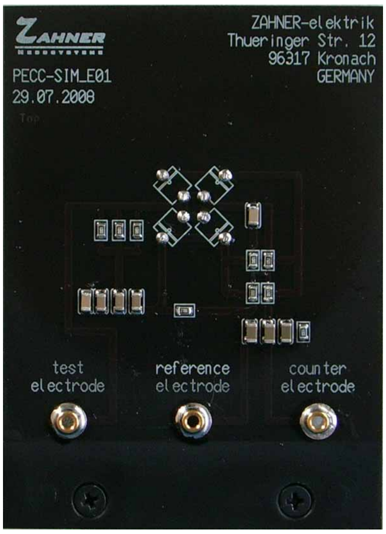

Fig. 2 SIMPECC reverse side.

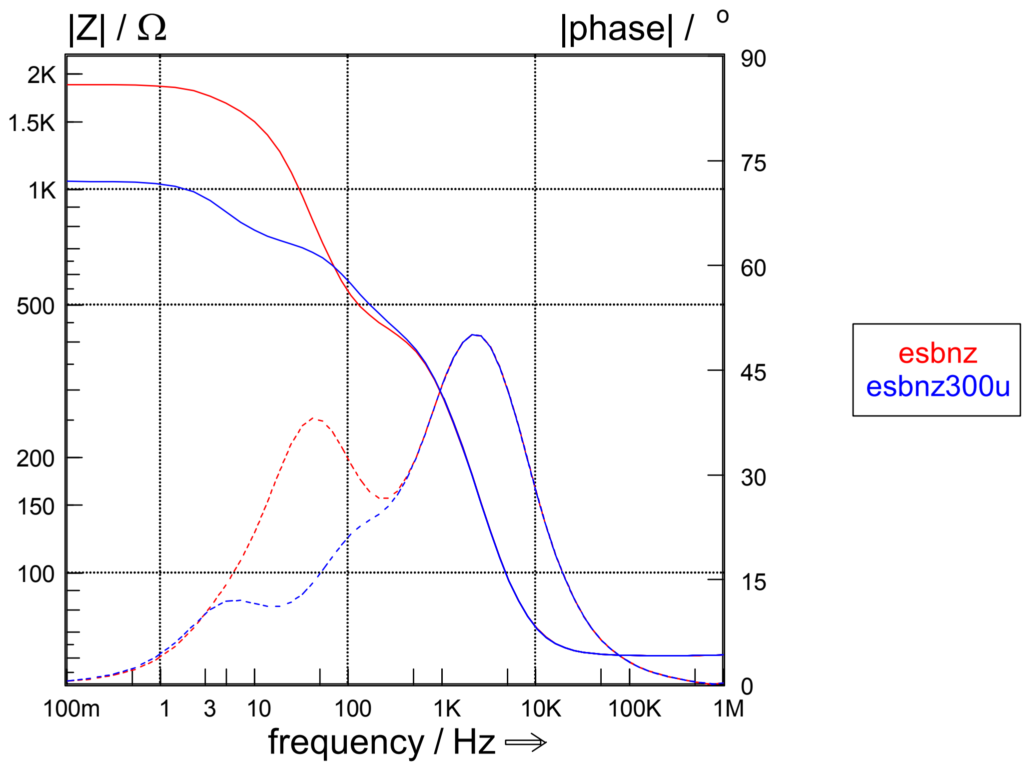

Fig. 3 Impedance spectrum of a SIMPECC at zero voltage bias under illumination. The photocurrent was 100 µA (red curve, esbnz) and 300 µA (blue curve, esbnz300u).

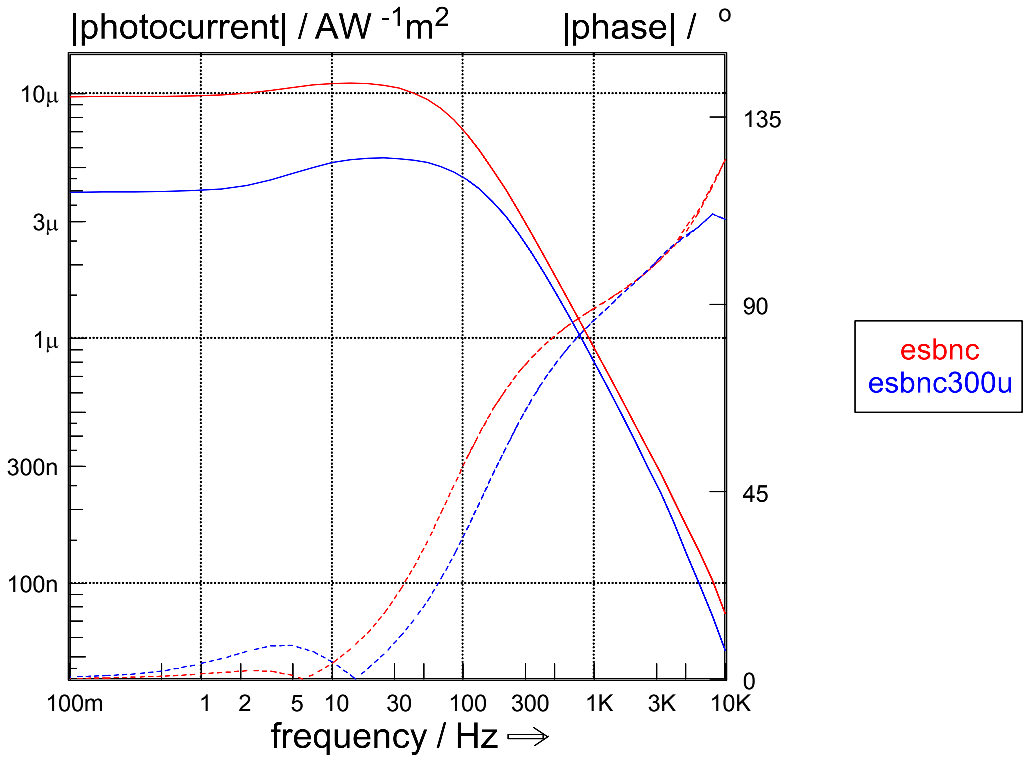

Fig. 4 Photocurrent spectrum (IMPS) of a SIMPECC at zero voltage bias under illumination. The photocurrent was 100 µA (red curve, esbnc) and 300 µA (blue curve, esbnc300u).

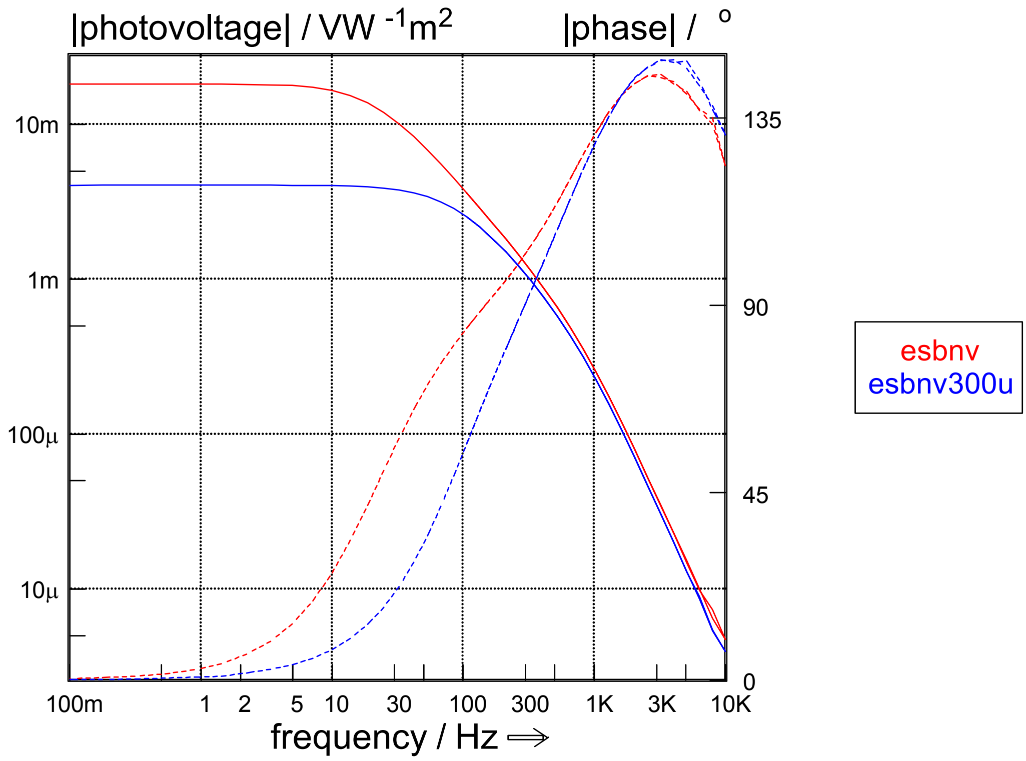

Fig. 5 Photovoltage spectrum (IMVS) of a SIMPECC at a photocurrent of 100 µA (red curve, esbnv) and 300 µA (blue curve, esbnv300u).