Journal of the Serbian Chemical Society
JSCS@tmf.bg.ac.rs • www.shd.org.rs/JSCS
J. Serb. Chem. Soc. *81* (12) S379–S381 (2016) *Supplementary material*

SUPPLEMENTARY MATERIAL TO

The pH measurement with glass electrode in an electromagnetic field

DRAGAN VESELINOVIĆ[1] and ZORAN VELIKIĆ[2]*

[1]*Faculty of Physical Chemistry, University of Belgrade, P. O. Box 137, 11000 Belgrade, Studentski trg 12–16, Serbia and* [2]*Institute of Physics, University of Belgrade, P. O. Box 68, Pregrevica 118, 11080 Zemun, Serbia*

J. Serb. Chem. Soc. *81* (12) (2016) 1407–1414

MEASURING SYSTEM AND PROCEDURE

The scheme of the amplifier is presented in Fig. S-1. All the components were manufactured by Mini Circuits. The basic amplifier is LZY-22. It possesses the needed frequency range and the output power within the required limits. It has a multiple output protection as well as a stable operation within a wide range of output impedances.

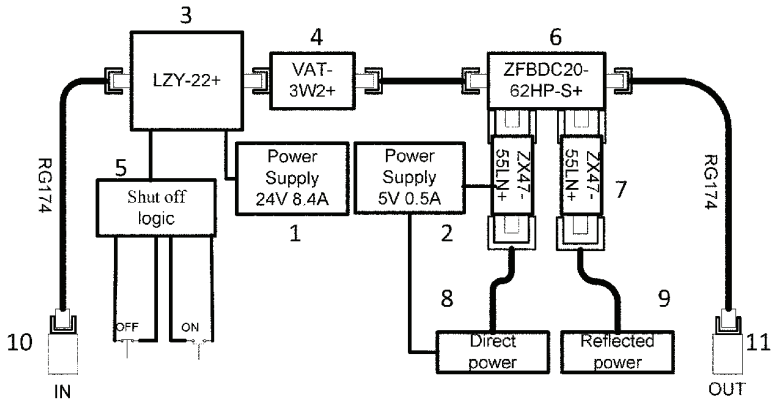

Fig. S-1. Scheme of the amplifier; 1. power supply a, 2. power supply b, 3. power amplifier, 4. attenuator, 5. shut off logic, 6. bi-directional coupler, 7. detector, 8. display direct power, 9. display reflected power, 10. input (from signal generator), 11. output (to cooper plaques).

The purpose of the remaining components is protection of the basic amplifier and the measurement of the output power, both direct and reflected, the values of which are shown on two displays. There are also components for power supply of the amplifier and the measuring circuits. The logical circuits turn the amplifier on and off.

* Corresponding author. E-mail: velikic@ipb.ac.rs

This device covers the frequency range of 20–200 MHz (radiofrequency span) with the possibility of changing and recording of output power of the reflected and dispersed electromagnetic radiation within the range of 0.01–3 W.

The system for solution pH measuring in the electromagnetic field

This system is presented schematically in the Fig. S-2. It consists of pH-meter /6/ connected to the electrodes /5/ in the cell /4/ with the solution. The cell is positioned between the plaques /3/ connected with the device for electromagnetic field production, consisting of amplifier /2/ and signal generator /1/. One to three magnetite rings is put on the cables connecting the electrode and the pH-meter, depending of the aim of the measurement, *i.e.*, to compensate the indirect influence of parasite electromagnetic fields.

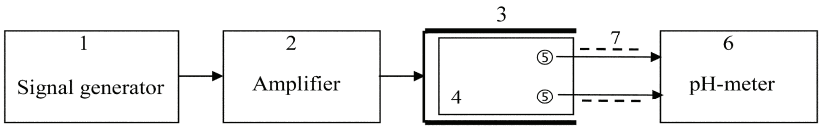

Fig. S-2. The system for solution pH measurement in an electromagnetic field: 1. signal generator, 2. amplifier, 3. copper plaques, 4. the cell for the to be examined solution, 5. electrodes for pH measurement, 6. pH-meter and 7. magnetite rings.

Measuring procedure

The cell for the measurement of solution pH was rinsed first with distilled water and then with the buffer solution that was used for further measurements, except when pH of distilled water was measured. After rinsing, buffer solution was introduced, and the electrodes were positioned. The cell was left to equilibrate for 15 min. The measured solution in the cell was at room temperature controlled with thermometer. The temperature changes during one measurement series (not more than 2 hours) were below 0.1°C, because the laboratory is equipped with an air-conditioner. Thermostat was not applied because its electrical system could influence on the measurements being in progress.

After preparing the measuring cell, the electrodes were connected with the pH-meter, which had previously been turned on for at least 15 min to achieve stable operating condition. After that, pH measurement started and after 1 min to 2 min, the obtained value was recorded. The cell was subsequently exposed to an electromagnetic field with a selected frequency and output power and after 2–3 min of stabilization, the pH value show at the instrument scale was recorded. This value was the "recorded pH value" that was not the true solution pH value because it is the result of a possible simultaneous influence of the electromagnetic field on the measuring system (electrodes), H^+ as well as other components in the solution. The procedure was repeated after changing the frequency or the electromagnetic field power.

For the elimination of the indirect influence of the electromagnetic field on the recorded pH value through the influence on the external cables, 1, 2 or 3 magnetite rings were put on the ends and the middle of the cables that connect the electrode with the pH-meter.

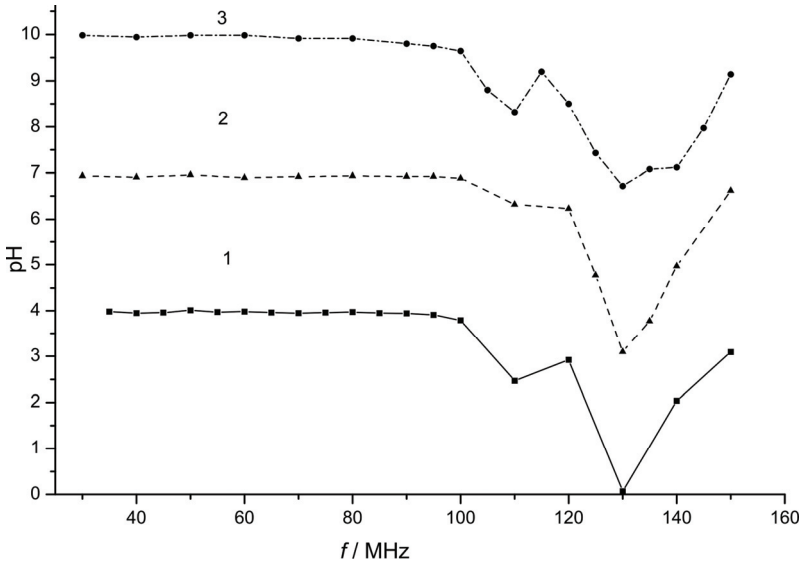

Fig. 5. The "recorded pH values" spectra of buffer solutions of pH 4.0 (1), 7.0 (2) and 10.0 (3) using the same combined glass electrode.