Summary of: Multi-analyte biochip (MAB) based on all-solid-state ion-selective electrodes (ASSISE) for physiological research.pdf

Key Findings and Quantitative Results:

- **Working Lifetime:** - PEDOT:PSS: The effective surface area of PEDOT:PSS was calculated to be 4.4 x 10^-11 cm^2 and 5.8 x 10^-11 cm^2 for H+ and CO3^2- respectively, which is significantly smaller than previous reported electrodes. - PEDOT:CaSO4: The effective surface area for PEDOT:CaSO4 was calculated to be 5.8 x 10^-11 cm^2 and 4.4 x 10^-11 cm^2, again smaller than PEDOT:PSS.

- **Calibration Results:** - pH range: The slope for pH 4 to 9 ranged from -30 to -17 mV. - CO3^2- range: The slope for CO3^2- from 0.01 mM to 1 mM ranged from -30 to -17 mV. - Ca2+ range: The slope for Ca2+ from 0.01 mM to 1 mM ranged from -30 to -17 mV.

- **Measurement Linear Range:** - pH range: The linear range for pH 4 to 9 was from 4 to 9. - CO3^2- range: The linear range for CO3^2- from 0.01 mM to 1 mM was from 0.01 mM to 1 mM. - Ca2+ range: The linear range for Ca2+ from 0.01 mM to 1 mM was from 0.01 mM to 1 mM.

- **Comparison to Conventional ISEs:** - The slope for CO3^2- measurements was similar to conventional electrodes and planar electrodes.

- **Advantages:** - Size: The MAB is 10 x 11 mm, making it versatile for confined monitoring situations. - Versatility: It can monitor pH, CO3^2-, and Ca2+ simultaneously. - Multiplexed sensing: The MAB can sense multiple analytes simultaneously.

- **Limitations:** - The pH range for CO3^2- measurements was limited to 0.01 mM to 1 mM due to the availability of carbonate species in the solution.

- **Future Work:** - Exploration of pH dependence of carbonate ions for more accurate measurements. - Development of a 3D electrode format for measuring Ca2+ levels in germinating fern spores.

- **References:** - Migdalski, J., Bas, B., Blaz, T., Golimowski, J., & Lewenstam, A. A Miniaturized and Integrated Galvanic Cell for the Potentiometric Measurement of Ions in Biological Liquids. J. Solid State Electrochem. 13,149-155 (2009). - Oelβner, W., Hermann, S., & Kaden, H. Electrochemical Sensors and Sensor Module for Studying Biological Systems in Space Vehicles. Aerospace Science and Technology. 1, 291-296 (1997). - Buck, R. Ion Selective Electrodes in Analytical Chemistry, Plenum Press, New York, (1980). - Song, F., Ha, J., Park, B., Kwak, T.H., Kim, I.T., Nam, H., & Cha, G.S. All-solid-state Carbonate Selective Electrode based on a Molecular Tweezer-type Neutral Carrier with Solvent-soluble Conducting Polymer Solid Contact. Talanta. 57, 263-270 (2002).