Non-enzymatic glucose sensing Au-Ti platform covered with photopolymerized poly(zwitterionic) coating with enhanced selectivity and durability in human serum

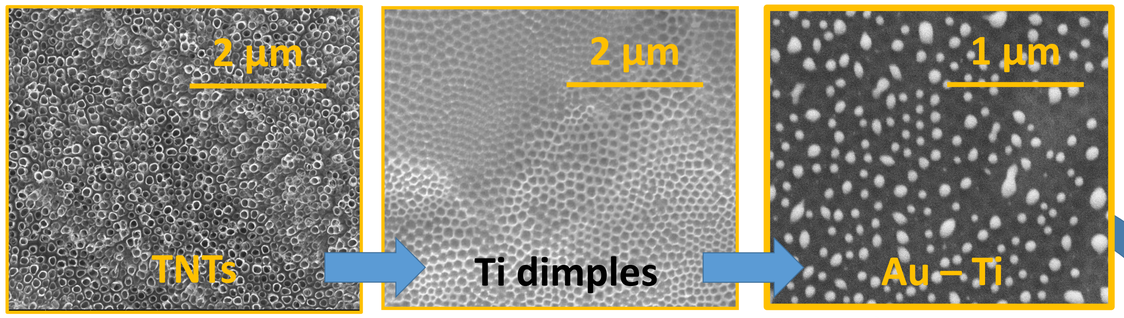
[a,b]Adrian Olejnik*, [a]Katarzyna Siuzdak, [b]Anna Dołęga, [b]Jakub Karczewski, [a]Katarzyna Grochowska

[a]*The Szewalski Institute of Fluid-Flow Machinery, Polish Academy of Sciences, 14 Fiszera st., 80-231 Gdańsk, Poland*

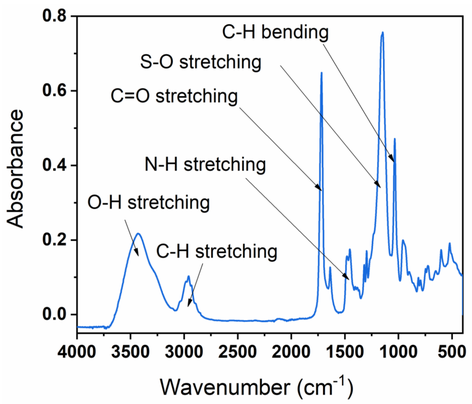
[b]*Gdańsk University of Technology, 11/12 Narutowicza st., 80-233 Gdańsk, Poland* **aolejnik@imp.gda.pl*

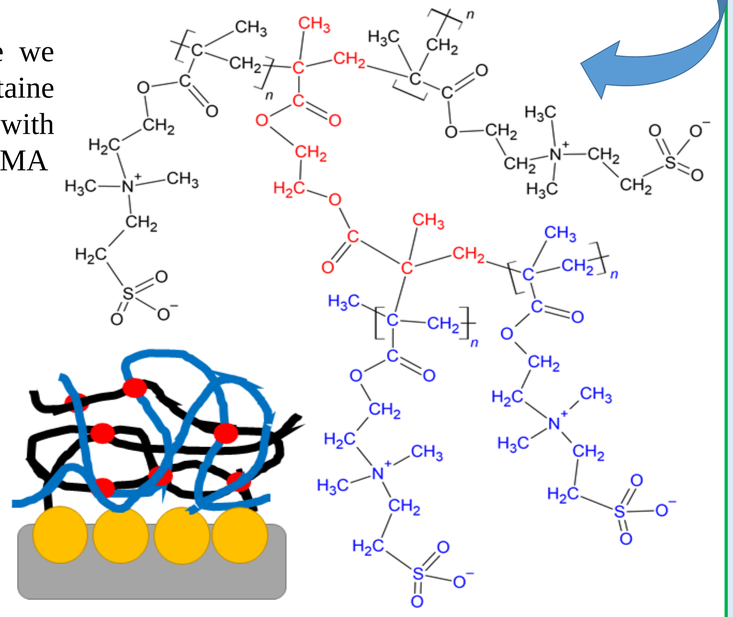
Synthesis and structure investigation

In here, we present glucose sensitive Au-Ti electrodes obtained via anodization of Ti foil and its subsequent chemical etching [2]. Later on, thin gold film is sputtered and further dewetted, so that gold nanoparticles are created and embedded in the titanium template:



As a coating for studied electrode we propose photopolymerized sulfobetaine methacrylate SBMA crosslinked with ethylene glycol dimethacrylate EGDMA i.e. (p(SBMA:EGDMA)).



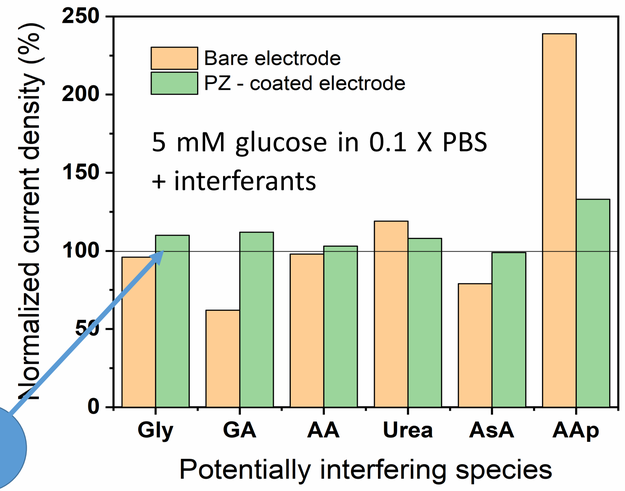


Polymeric zwitterions are a promising solution due to their superhydrophilicity and high resistivity to biofouling in media containing various biomolecules and cells [3].

Non-enzymatic electrochemical glucose sensors have numerous potential advantages over traditional enzymatic ones. Among them, one can distinguish cheaper and easier fabrication route, as well as higher resistance towards pH and temperature changes. However, there are certain drawbacks of non-using enzymes, i.e. low selectivity towards glucose and threat of interference with other electroactive compounds such as ascorbic acid (AA), acetaminophen (AAp), acetylsalicylic acid (AsA), urea and aminoacids e.g. Glycine (Gly) and Glutamic acid (GA) [1]. Therefore, there is a strong requirement for strategies enhancing the selectivity by eliminating interference and prolonging the sensing capability in human physiological fluids.

Interference reduction

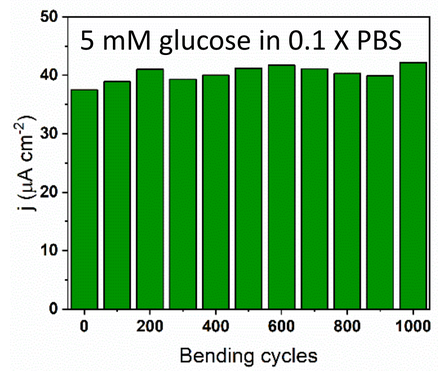
According to our electrochemical studies, pSBMA:EGDMA coating provides significant interference reduction from AA, aminoacids, AsA, AAp and urea. Moreover electrochemical activity is preserved in diluted human serum indicating possible application of fabricated material in glucose monitoring in real samples.



Conclusions

- Au-Ti electrodes are active towards glucose oxidation in neutral 0.1 X PBS environment
- Cross-linked poly(zwitterionic) coating was obtained via simple photopolymerization
- Material posseses stability of response after 1000 bends and interference is strongly reduced

Superior mechanical durability



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References:

[1] Hwang, D. W., Lee, S., Seo, M., & Chung, T. D. (2018). Recent advances in electrochemical non-enzymatic glucose sensors–a review. *Analytica Chimica Acta*, 1033, 1-34.

[2] Olejnik, A., Siuzdak, K., Karczewski, J., & Grochowska, K. (2020). A flexible Nafion coated enzyme-free glucose sensor based on Au-dimpled Ti structures. *Electroanalysis*, *32*(2), 323-332.

[3] Venault, A., & Chang, Y. (2018). Designs of zwitterionic interfaces and membranes. *Langmuir*, *35*(5), 1714-1726.