Ukrainian Conference
with International Participation

CHEMISTRY, PHYSICS AND TECHNOLOGY OF SURFACE

dedicated to the 95th birthday of
Academician Oleksii Chuiko

28-29 May 2025
Kyiv
Ukraine

Poster Presentation

1. Theory of Chemical Structure and Reactivity of Solid Surface

1. **V.Ya. Chernii**[1], V.Ya. Demchenko[2], N.G. Kobylinska[2]. **New solid-phase reagents based on silica modified with 1,10-phenanthroline derivatives for visual-test determination of Fe(II) ions in aqueous solution** (*[1]V.I. Vernadsky Institute of General and Inorganic Chemistry, NAS of Ukraine, Kyiv, [2]A.V. Dumansky Institute of Colloid and Water Chemistry, NAS of Ukraine, Kyiv*).
2. **O.V Gornostai**[1], M.A. Khokhlov[1], Y.A. Stelmakh[1], J.A. Khokhlova[1], I.M. Maksymchuk[2]. **Magnesium-based biomedical coatings for implants: potential and challenges** (*[1]E.O. Paton Electric Welding Institute, NAS of Ukraine, [2]Frantsevich Institute for Problems of Materials Science, NAS of Ukraine, Kyiv*).
3. **G.D. Ilnytska**[1], V.E. Diyuk[2], A.V. Yatsimirskii[2], V.I. Lavrinenko[1], V.V. Smokvyna[1], O.B. Loginova[1], I.M. Zaitseva[1]. **Surface properties of high-strength synthetic diamond grinding powder** (*[1]V. Bakul Institute for Superhard Materials, NAS of Ukraine, Kyiv, [2]Taras Shevchenko National University of Kyiv, Ukraine*).
4. O.A. Dudarko[1,2], **N.G. Kobylinska**[3]. ***In situ* functionalized natural diatomaceous earth as a low-cost adsorbent for the removal of UO_2^{2+} ions from aqueous solution** (*[1]Chuiko Institute of Surface Chemistry, NAS of Ukraine, Kyiv, [2]Swedish University of Agricultural Sciences, Uppsala, [3]A.V. Dumansky Institute of Colloid and Water Chemistry, NAS of Ukraine, Kyiv*).
5. T.S. Hubetska[1,2], **N.G. Kobylinska**[1]. **Sorptive removal behind catalytic degradation of pharmaceuticals from aqueous solutions using Ni(II),Fe(III)-layered double hydroxides and their derivatives** (*[1]A.V. Dumansky Institute of Colloid and Water Chemistry, NAS of Ukraine, Kyiv, [2]Nanomaterials and Nanotechnology Research Center (CINN-CSIC), El Entrego, Spain*).
6. **V.V. Poltavets**, H.S. Maslak, O.V. Netronina. **Development and characterization of MnO_2-based electrode for a microfluidic device. Features of use in the study of oxidative stress** (*Department of Biochemistry and Medical Chemistry, Dnipro State Medical University, Ukraine*).
7. **D. Starokadomsky**[1,2], M. Helbak[3], M. Reshetnyk[4], O. Kachorovska[3], N. Bodul[3]. **The influence of the nature of aqueous solutions on the surface structure and properties of gypsum stone** (*[1]Chuiko Institute of Surface Chemistry, NAS of Ukraine, Kyiv, [2]M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation, NAS of Ukraine, Kyiv, [3]Kyiv Junior Academy of Sciences of Ukraine, [4]National Museum of Natural History, NAS of Ukraine, Kyiv*).
8. **O.O. Zhokh**, A.I. Trypolskyi, P.E. Strizhak. **Intrinsic kinetics of methanol conversion over carbon nanotubes** (*[1]L.V. Pisarzhevsky Institute of Physical Chemistry, NAS of Ukraine, Kyiv*).

2. Physical Chemistry of Surface and Interfacial Phenomena

9. **L.O. Abramenko**[1], A.V. Korotun[1,2], V.M. Matiushyn[1]. **Optical resonances in a dimer with spherical metal nanoparticles** (*[1]National University "Zaporizhzhia Politechnic", Ukraine, [2]G.V. Kurdyumov Institute for Metal Physics, NAS of Ukraine, Kyiv*).

Development and characterization of MnO_2-based electrode for a microfluidic device. Features of use in the study of oxidative stress

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Microfluidic systems as a new analytical method have been developed not so long time ago, but their use opens up great prospects [1]. In the development of electrochemical microfluidic biosensors, the formation of working electrodes is important. Main characteristics of such electrodes are mechanical strength, sensitivity and selectivity.

We understand oxidative stress as an increase in free radicals, which leads to disruption of redox signal transmission and destruction of molecules. The main relatively stable intermediate of enzyme antioxidant reactions is hydrogen peroxide. Therefore, H_2O_2 is the main analyte that is fixed in microfluidic devices. MnO_2 for working electrode material is selected as a known catalyst for the decomposition of hydrogen peroxide.

After a systematic study, it was determined that the maximum catalytic properties of manganese dioxide are obtained using the following formation method. The MnO_2 coating was formed by cyclic voltammetry method (CV) in a water solution of 0.005 M $MnSO_4$, 0.5 M Na_2SO_4 with pH 1 during 30 cycles at the range of potentials 0.65 V – 2.1 V vs. Ag/AgCl/3M KCl and subsequently dried at 60 ^{0}C for 12 hours. The sediment was characterized by scanning electron microscopy, electrochemical impedance spectroscopy and X-ray photoelectron spectroscopy. In a microfluidic cell we reproducibly recorded H_2O_2 concentrations in the range from 0.1 mM to 3 mM.

In biochemical studies, blood plasma of laboratory rats was taken in a calm state and in a state of stress. The activity of the enzyme catalase, which decomposes hydrogen peroxide, was studied. The difference in the amount of H_2O_2 fixed by the electrode when mixing a given amount of peroxide with blood plasma and without mixing was assessed. Thus, we observe the work of the enzyme over time in vitro. None of the known enzymatic analysis methods provides such data.

Our current efforts are focused on deciphering the antioxidant activity data of wounded soldiers in collaboration with Dnipro hospitals. This will help adjust treatment and rehabilitation.

1. P. Lacher, *et al.* Biosens. Bioelectron. X. **11** (2022) 100218.