МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ’Я УКРАЇНИ
БУКОВИНСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ

М А Т Е Р І А Л И

106-ї підсумкової науково-практичної конференції
з міжнародною участю
професорсько-викладацького колективу
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Матеріали підсумкової 106-ї науково-практичної конференції з міжнародною участю професорсько-викладацького колективу Буковинського державного медичного університету (м. Чернівці, 03, 05, 10 лютого 2025 р.) – Чернівці: Медуніверситет, 2025. – 450 с. іл.

У збірнику представлені матеріали 106-ї науково-практичної конференції з міжнародною участю професорсько-викладацького колективу Буковинського державного медичного університету (м. Чернівці, 03, 05, 10 лютого 2025 р.) зі стилістикою та орфографією у авторській редакції. Публікації присвячені актуальним проблемам фундаментальної, теоретичної та клінічної медицини.

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The aim of the study. To review advanced materials current state used in flexible wearable sensors, the physical limitations they encounter and future prospects to overcome these challenges.

Material and methods. Combination of such properties of conductive polymersasgood electrical conductivity, mechanical flexibility, ease of processing and integrating with other substrates, makes them suitable for such medical applications, as sensors for different electrography techniques. Advantages of flexible sensors fabricated from graphene and carbon nanotubes (CNTs) are rapid response times and high signal-to-noise ratios. Enhanced sensor sensitivity due high surface area with other their electrical, thermal and mechanical properties makes them appropriate for biosensors. Metal nanowires, particularly silver and gold, provide excellent conductivity and flexibility, making them suitable for transparent and stretchable electronics. Their ability to form percolating networks allows for effective signal transmission, even when stretched. However, brittleness and susceptibility to oxidation are issues for long-term applications in wearable sensors.

Results. There are several physical limitations on the optimal performance of flexible wearable sensors. 1. Repeated bending and stretching: flexible sensors must withstand it without losing functionality. Designing substrates that maintain sensor integrity under significant deformation remains challenging. 2. Materials for wearable sensors that interface directly with the skin must be non-toxic, non-allergenic and capable of withstanding the harsh biological environment. Current materials often fail to meet these criteria over extended periods, leading to skin irritation and sensor degradation. 3. Such environmental factors as moisture, temperature fluctuations and electromagnetic interference are causes of unstable signals and reduced accuracy in physiological measurements of flexible wearable sensors due to sensitivity of most of advanced materials to these factors. 4. Current battery technologies may not provide the necessary energy density or flexibility, leading to limitations on continuous operation of wearable sensors.

Prospective directions overcoming the limitations of advanced materials for flexible wearable sensors requires innovative strategies and interdisciplinary collaboration. 1. The ways to achieve increasing of flexibility and improving of sensing capabilities are to research into new materials, such as stretchable ionic conductors and self-healing polymers and combination of different materials, such as polymers with graphene or CNTs, to obtain hybrid materials. Some new materials can overcome mechanical and biocompatibility limitations, providing greater durability and comfort for users. 2. Sensors with improved performance metrics can be created by integration of nanotechnology and microfabrication techniques. 3. Coating existing materials with protective layers could enhance their biocompatibility and environmental resilience. 4. Incorporating energy harvesting technologies, such as piezoelectric or thermoelectric materials, is the way to enable self-powered sensors with extended the operational life of wearable devices and enhanced user convenience.

Conclusions. The development of advanced materials for flexible wearable sensors of BANs presents both significant opportunities and challenges. While current materials like conductive polymers, graphene and metal nanowires demonstrate promising characteristics, their limitations in mechanical stability, biocompatibility and environmental sensitivity need to overcome. Future research directions focus on new materials, advanced fabrication techniques, protective coatings and energy harvesting solutions. The integration of these innovative materials will be critical in shaping the future of healthcare and personalized medicine.

Makhrova Ye.G.

THE USE OF BONE PLATES IN TRAUMATOLOGY

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Introduction. Bone plates are essential tools for stabilizing fractures, especially in complex or unstable cases. They offer structural support and help maintain proper alignment, thereby aiding the healing process. This study explores the applications, benefits and potential complications associated with bone plates in trauma surgery.

The aim of the study. The primary aim of this study is to evaluate the effectiveness and safety of bone plates in managing traumatic fractures. Clinical outcomes, complication rates and the influence of various plate materials and designs on healing were analyzed.

Material and methods. This study involved a retrospective analysis of patients who underwent bone plate fixation for traumatic fractures. Data were collected from patient records, including demographics, fracture types, plate specifications, and post-operative outcomes. Statistical analysis was conducted to assess correlations between plate types, complication rates and successful healing outcomes.

Results. Preliminary findings indicate a high success rate in fracture healing (over 85%) across different fracture types. Complications, including infection and hardware failure, occurred in approximately 10% of cases, with rates varying based on plate material (stainless steel vs. titanium) and fracture location. The study also underscores the importance of biomechanical stability from different plate designs in facilitating recovery.

Conclusions. Bone plates are a reliable option for the surgical treatment of traumatic fractures, yielding favorable outcomes with manageable complication rates. Choosing the appropriate plate material and design is critical for optimizing healing and reducing risks. Further research is recommended to refine surgical techniques and enhance patient outcomes in traumatology.

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PHOTOSENSITIVITY SPECTRA OF NANOCOMPOSITE STRUCTURES BASED ON LAYERED SEMICONDUCTOR InSe AND IONIC SALT $RbNO_3$

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Introduction. Intense research of 2D materials has led to the the creation of a new class of structures that have "ionotronic" characteristics. They consist of thin layers of semiconductors with 2D conductivity, metal oxides and materials with ionic conduction. The conductivity in the semiconductor layer of ionotronic structures depends on the motion of ions in electrolyte, which may be affected by applying a low d.c. voltage (several volts). The double electric layer formed by electrons and ions can be about of 0.5 nm thick. Solid-state ionotronic structures based on layered InSe crystals and ionic salt $RbNO_3$ can be prepared by introducing this melted ionic salt into InSe van-der Waals gaps.

The aim of the study. The study aims to explore the use of indium selenide as a base material for creating photosensitive structures of various types, including metal/semiconductor contacts, homojunctions and heterojunctions.

Materials and methods. In our experiment we used an InSe ingot grown by the Bridgman method. It had a crystalline structure of γ-polytype and n-type conductivity with an electron concentration of the order of 10^{15} cm^{-3} at room temperature. Thin plates with typical dimensions $4\times4\times0.2$ mm^3 were obtained by their mechanical splitting off along of layers from the grown ingot. A melted ionic salt $RbNO_3$ was inserted between the layers of InSe crystals at a temperature of 412°C during 12 minutes. Then, on the frontal surface (0001) of the nanocomposite material a thin In layer (some tens nm thick) was deposited by thermal sputtering in vacuum that was used as an ohmic contact to InSe.

Results. The photoresponse of initial pure n-InSe crystals along the crystallographic C axis is restricted by a high density of stacking faults that cause low values of diffusion length for non-equilibrium photocarriers (a few μm). In our case, the ring-shaped ionic nanostructures are located at small distances (several tens nm) with respect to each other that is much less than the diffusion length of non-equilibrium carriers in InSe crystals. The photo-response of vertical 2D structures is proportional to the ratio of lifetime τ_l of non-equilibrium carriers (holes in n-InSe) to the time of transfer τ_t of (transition of electrons between the contacts). The value of τ_t depends on the distance t between the contacts, applied d.c. voltage V and a value of electron mobility μ as $\tau_t = t^2/\mu V$. Therefore, photosensitivity in 2D materials increases with decreasing t and increasing V. These