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### **INTERNATIONAL WORKSHOP**

**«Multiscale Biomechanics and Tribology  
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### **МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ**

**«Перспективные материалы с иерархической структурой  
для новых технологий и надежных конструкций»**

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AGE OF CHEMISTRY IN OIL AND GAS RECOVERY

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As the worldwide oil and gas consumption continues to grow, we are facing with unprecedented challenges: how will we be able to meet the world hydrocarbon demand throughout the 21st century. Although the present dominance of fossil fuels will be much less in the future, the hydrocarbons will probably remain indispensable for the humankind. Unfortunately, the recovery rate of conventional hydrocarbons is unacceptably low (~35%) at present and its improvement is highly limited using traditional production technologies. Under these circumstances, the basic alternatives are the following: further increase of recovery efficiency and replace of conventional hydrocarbons with unconventional ones. Despite attractive features of the later alternative (shale/tar sand oil, shale/tight sand gas, hydrates and CBM) it is a stunning circumstance that the recovery efficiency of unconventional hydrocarbons is often less than 10%.

Numerous, and gradually increasing number of papers prove that wider and routine application of advanced chemical methods will become inevitable part of production methods in the coming years, and emblematic authors postulate that all intensive technology are partly or fully based on chemical mechanisms. Since the present comprehension and interpretation of recovery methods seems to be obsolete and patchy, new interdisciplinary approach is necessary to step forward smart flooding and stimulation technologies, and chemistry, more exactly *oilfield chemistry* will play a fundamental role to realize those goals. Oilfield chemistry is a multidisciplinary branch of sciences integrating the knowledge of reservoir engineering, production engineering chemistry, and chemical engineering and many more. Mission of oilfield chemistry is to increase the recovery efficiency up to a possible ultimate limit making available the explored hydrocarbon resources and thus, meeting the global demand of humankind as long as possible. This new branch of engineering science deals with special and unique feature in respect to the source of problems, scientific approach, development, and practical application of technologies. Oilfield chemistry is focusing on processes taking place

- at high pressure and temperature,
- in multiphase (oil/water/gas/rock) systems,
- in heterogeneous porous and fractured reservoirs, and
- under dynamic conditions.

The oilfield chemistry already became a core element of exploration (geochemistry), drilling (mud chemistry), stimulation (fracturing, acidizing, bottomhole clean-up), productivity and injectivity improvement (chemical selective shutoff and conformance treatment), mitigation of formation damage (scale and corrosion chemistry, paraffin and asphaltene removal). In addition, IOR/EOR chemistry (chemical, gas and thermal and microbial methods), water management (water chemistry), phase separation and enrichment in surface facilities (emulsion and suspension breaking) are also part of enhanced chemical methods. Further, chemistry also has fundamental role in recovery of unconventional hydrocarbons by leaching and extraction of heavy oils and bitumens, tapping gas from tight sand shale reservoirs and basin concentrated gas accumulation, methane production from coal seams, chemical decomposition of hydrates, etc. All these areas will be addressed in the presentation focusing on the state-of-the-art and the predicted importance of chemicals and chemical technologies in the coming years. In addition a brand new classification of enhanced methods will be discussed using thermodynamic approaches. Namely, it will be indicated that "Age of Chemistry" is already alive, and chemistry will have a strong and beneficial effect on innovation of the upstream sector of the petroleum industry.