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Experimental Study of the Transfer Characteristic of a Molecular Electronic Sensor for a Borehole Seismic Exploration of Oil and Gas Fields at Great Depth

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Modern oil wells are longer, deeper and hotter than ever before. This is due to depletion of easily accessible hydrocarbon deposits and need to develop deep oil and gas fields (≥7км). Such depths are characterized by high ambient temperatures (120 - 260 ° C) and pressures (69 - 241 MPa). That is why the development, operation and probing of deep fields require to use a specific elemental base (classical equipment is not applicable for such purposes). In addition to stable operation at high temperatures and pressures, sensors for downhole sondes should have high sensitivity. In this regard, sensors based on molecular-electronic technology (MET), which have extremely high sensitivity and low self-noise, can be a good alternative to existing solutions [1], [2].

In this scientific work, high-temperature sensor based on MET has been developed. For the first time, the transfer characteristics of the MET sensor obtained in the extended temperature range (25 - 125 ° C) and external pressure of 10 atm. New theoretical model has been created, based on the obtained experimental data, which allows describing analytically the transfer function of MET sensor in an extended temperature range. A physical model was tested with several alternative techniques. The obtained results will help create a fundamentally new high-temperature sensor based on MET with parameters significantly different from existing market solutions.

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Biography:

Ilya A Evseev was born in Podolsk, Russia, in 1995. He has graduated from the Lyceum №1511 at the NRNU “MEPhI” in 2013. He is a finalist of Intel ISEF 2013. He had won grant at competition UMNIK 2017 from Foundation for Assistance to Small Innovative Enterprises (FASIE). He has received the B.S. degrees in applied mathematics and physics from the Moscow Institute of Physics and Technology (MIPT), Moscow in 2017. He has been a Research Assistant with the Center for Molecular Electronics, MIPT, since 2016. His research interests include electronics, electrochemistry, applied physics and seismology.