Lately, observed are changes in structure of energy production industry. Increasing importance of such sources as natural gas belongs to strategy of protection against climate changes. With increasing demand for gas fuels not only grows the infrastructure, but also the need for its reliability in operation that is required form gas main operators (owners).
Methane, that is the main component of the natural gas designed for distribution and usage, defines its quality and energy value. All additions, that the current methods of the gas treatment cannot totally eliminate, such as ethane, nitrogen, carbon dioxide and steam, are decreasing its calorific value. Moreover, even trace quantities of CO2 and water are promoting growth of the microorganisms. Those microbes can extract elements necessary for survival and development from the steel used for gas pipelines construction. Steel surface is commonly colonized as it not only includes the vital element, carbon, but also can be used as source of micro- and microelements (sulfur, phosphor, iron and manganese, respectively). It results in adhesion of microorganisms to the pipeline surfaces and development of biofilms, what in the end leads to change in electric potential. At the same time appearance of the anode and cathode areas results in degradation if the metals used in gas pipelines construction.
In literature, the most commonly described groups of the microorganisms responsible for corrosion are bacteria reducing sulfates (SRB) and thiosulfates (TRB). Their participation in the process was decribed for the firs time by Van Wolzonge Kühra and Van der Vlugta in 1934, and since then many times confirmed (for example by Cord-Ruwisch et al in 2000).
Sulfate-reducing bacteria, during their in anaerobic respiration proces, use hydrogen for the reduction of sulfate (SO42-). Released as a result of these reactions sulfate ions (S2-) can react with iron II ions (Fe2 +) and create in anode areas the insoluble iron sulphide (FeS). Sulphate ions which combine with the hydrogen ions (H +) form the cathodic areas creating sulfide (H2S), which is additional corrosion factor.
The existing research prove that live organisms are responsible for about 10-20% of the corrosion present in the industry, and one of the areas of its occurrence of the so called microorganism induced corrosion (MIC) are gas pipelines. It is estimated that over 40% of the corrosion of the inside of gas mine has bacterial background [Jan-Roblero J. et al., 2004; Mehanna M., et al., 2009; Mori K., et al., 2010].
Many years of experience in the gas network protection against corrosion will not eliminate the problem of corrosion which is induced by microorganisms (MIC) the inner side of the pipelines. Previously applied insulating coating and cathodic protection are ways to protect only the outer surfaces of gas installations. The scale of the failures caused by microbiological corrosion pose a threat to humans and environment, as well as cause the economic losses. The appearance of a leak in the pipeline, sudden gas leaks, often result in fire (eg. In Jankowo Przygockim).
Therefore the following project is devoted to expansion on the knowledge on the MIC problem on the inside surface of the gas pipeline and determination of the influence of the cathode protection, applied to the outside surface of the pipe, on the bacterial adhesion and growth on its inside surface.
No less important is obtaining more accurate knowledge of microorganisms inhabiting the gas network and the acquisition with information on the impact of the cathodic protection, commonly used on the gas pipelines, on the micro-organisms that reside within these systems. Currently there is no access to information that would explain whether used protection has also antimicrobial properties, although several groups of researchers have shown the negative impact of electric current on the development of microorganisms in aerobic conditions. The presence of the microorganisms and their metabolites in the environment can cause biodeterioration also inside the gas network, but there is no information about biocorrosion speed when the material is protected by means of electric current. Determination of microbial corrosion rate for pipelines protected by cathodic protection is another important aim of this project. A combination in one of research project investigations on the micro-organisms inhabiting the gas network and on microbiological corrosion rate of the steel with research on the cathodic protection of pipelines, will help to acquire new knowledge of the facts observed in the environment created by man.