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EDITOR'S PAGE

IS IT TIME TO IMPROVE THE STATUS OF OIL SHALE SCIENCE?

We hear a great deal these days about depletion of oil reserves and the need to explore alternative energy sources including oil shale. At a glance, it seemed difficult to write something general while at the same time meaningful about a quite widely discussed topic such as oil shale utilization, especially for the editor's page of the scientific journal *Oil Shale*. Partly this is due to the worldwide nature of oil shale utilization and partly due to the extensive information available through the internet and journals.

Therefore a good starting point as any is the oil shale research and technology in Estonia. In Estonia, there are two types of oil shales: kukersite and dictyonema argillite (reserves are estimated many times greater than those of kukersite oil shale). Kukersite oil shale has been extensively studied from both scientific and technological viewpoints for over a century. Currently kukersite is commercially used for electricity production in power plants, where the technology used is based on pulverized and fluidized bed combustion, and converting to oil in solid heat carrier retorts and directly-heated generators. Historically a number of other technologies were used in commercial or pilot scale: gasification in chamber ovens; two stage combustion with direct air-blown fluidized bed gasification as the first stage; in-situ processing; conversion to oils in a tunnel oven, a Davidson rotary retort and a fluidized-bed retort. Kukersite is one of higher oil-yield oil shales basing on characterization by the Fischer Assay method. Its chemical composition is quite uniform, the kerogen structure has been modeled, and considerable information is available on physical-chemical characteristics for both kukersite and its pyrolysis products; extraction and supercritical extraction yields have also been investigated. Although kukersite has been extensively studied, most of the information is available in different journals, books and theses published (mostly in Russian) in the former Soviet Union. There is also considerable amount of unpublished reports of original value that have been lost during the course of independence in the last decade. As for dictyonema argillite, significantly less information is available about upgrading it to more valuable products, and even if there have been many studies, these were not published for reasons of confidentiality. Key words for dictyonema argillite during previous utilization studies seemed to be mostly related to uranium. Dictyonema argillite yields less oil, basing on characterization by the Fischer Assay method, and it does not belong to the class of oil shales for which overground retorting is the preferred thermochemical conversion method. In additon, chemical composition of its kerogen is much less uniform than that of kukersite.

World oil shale science and technology have a long history, however, with considerable ups (around the Second World War and after Arab oil embargo) and downs. Oil shales are solid fuels of low energy content, and corresponding research and development have been quite chaotic with a notable exception of some specific locations like Estonia. Unfortunately even there oil shale research has gone through a period of dramatic decline during the last decade. However, due to depletion of oil reserves and emphasized importance of energy security, there is a promise that oil shale research and technologies will receive support from the government and private industry.

It is well known that world oil shale reserves vary widely in their kerogen content and composition; there also significant variations in depth and thickness of layers; there are commercially viable deposits located all over the world, all characterized by different thermal-conversion behavior, product yields and compositions; depending on the specifics of the deposit, there could be considerable variation among results obtained at analysis of different samples taken from the same deposits. In order to take the best advantage of up-to date analytical techniques and corresponding expertise, currently scattered at different laboratories over the world, an oil shale sample bank should be developed. This oil shale sample bank, similar to Argonne Premium Coal Sample Program, should contain, for comparative purposes, well-characterized identical samples from commercially viable deposits from all over the world. This should make it easier to adopt the progress made in engineering disciplines (fluid dynamics; thermodynamics; heat and mass transfer; property prediction), chemistry and coal science, and, basing on these, to make oil-shale science more predictive. There are many areas, where additional experimental and theoretical research is needed. For example, during the last three decades in coal science there has been a shift from simple kinetic models to more complex "network" devolatilization models. These models can provide detailed predictions of pyrolytic behavior for a wide variety of coals under variable temperature, pressure and heating rate conditions. Lately, some of them have been successfully applied to other fields: biomass (lignin, cornstalk, tobacco, hardwood) pyrolysis, prediction of NO_x emission from combustion, and used in predicting the behavior of fixed and fluidized-bed systems.

Before leaving the subject, let us hope that the observations proposed here together with all others contribute to the growth potential of oil shale science and development. How existing technologies will develop, and what kinds of new technologies could appear, cannot be known with certainty. Therefore one has to keep an open mind and consider many possibilities, even those which were discarded several decades ago as not economical.

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