12.4 **Discussion of Comprehensive Utilization of Oil Shale Ash**

Gan Shucai[1], Gao Guimei[1], An Baichao[1], Liu Zhaojun[2]

[1]College of Chemistry, Jilin University, Changchun, China, [2]College of Earth Science, Jilin University, Changchun, China

Oil shale is a kind of marlite containing combustible organisms, which is formed by the simultaneous sedimentation of granule mineral fragments and the rotting organisms. One of the main technologies available for utilizing oil shale resources is retorting oil shale to produce shale oil and gas, and the other is burning oil shale to generate electricity. Both of them produce a huge amount of residue. It not only can cause serious environmental pollution, but also result in loss of the other available elements. These problems limit the development of oil shale industry. How to effectively utilize oil shale ash (OSA) is an important issue. In this paper, samples of oil shale are taken from Huadian, Nong'an, Wangqing of Jilin Province. The oil shale mineral composition and the corresponding chemical composition of the OSA were determined. The results show that the ash contains a variety of inorganic elements. These inorganic elements will become raw materials of chemical products. The utilization techniques are as follows:

- *alumina* - Kaolinite and montmorillonite are all aluminium-rich minerals, and are activated during the distillation process of oil shale. Alumina can be leached by new hydrometallurgical techniques.
- *chemical industrial products of silica series* - The amorphous SiO_2 in the ash can be effectively used to prepare water glass, silica, and nano-silica. After leaching aluminum, the residue can produce water glass by hydrometallurgical techniques. Furthermore, water glass can reform silica and nano-silica by controlling the reaction conditions.
- *ferrite microwave absorbing materials* - Ferrite consists of complex oxides of iron and one or more other metal ions, and is a new type of non-metallic magnetic material. Ferric hydroxide residue, which is produced during the separation process of Al_2O_3 and other metallic elements can be prepared as ferrite magnetic material by the appropriate process conditions.
- *artificial marble* - Using the residue of the extraction of silica left as padding to prepare the artificial marble is reasonable in respect of available techniques.

In conclusion, using the above mentioned techniques, the OSA can be sufficiently utilized, with no solid residue left. The oil shale industry can gradually become a green industry.