Development of Alkaline Aluminosilicates Processing Technology

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Abstract

Alkaline aluminosilicates are of significant interest to the metallurgical and chemical industries, and deposits are widespread in countries like Russia, USA, China, Canada, Venezuela, Mexico, Iran, Egypt, Portugal, Spain, Bulgaria. They can present a viable alternative to bauxites. Complex and waste-free alkaline aluminosilicate processing technology to produce alumina, soda ash and cement was developed by VAMI in the 1st half of twentieth century, from idea to successful realization in several Russian facilities. Till now this technology has ensured competitive alumina production costs by processing all raw material elements into commercial products. For alumina production using this technology, the following raw materials are used: nepheline concentrate after apatite extraction from apatite-nepheline ores in the Khibiny mountains at Kola peninsula, and the Kiya Shaltyr nepheline deposit in the Krasnoyarsk region with a uniquely high alumina content (Al₂O₃ 26 – 28 %). Other nepheline sources in Russia and other counties are generally of lower quality (Al₂O₃ 19-22 %), and their processing results in more cement produced per tonne of alumina. An economically efficient beneficiation technology has been developed that opens the possibility for more efficient industrial processing of comparatively poor aluminosilicate raw materials in Russia and the rest of the world.

Keywords: alkaline aluminosilicates; processing properties; quality, beneficiation.

1. Introduction

Alkaline aluminosilicates (nepheline syenites, leucites, anorthosites, dawsonites) being widespread in the world are a promising but underestimated raw material source for aluminium production. Nepheline ores are the second most significant raw material for alumina production after bauxites. To date, alumina is produced from nepheline ores at industrial scale only in Russia using two major sources (Kiya-Shaltyr in the Kemerovo Region in Siberia; Kukisvumchor, Yukspor, Rasvumchor in the Murmansk Region). The industrial value of alkaline aluminosilicates is defined by the possibility to produce multiple products (soda ash, potash, cement, Ga, Cs, Rb), ensuring the profitability of processing the raw material where the silica content is 1.5 – 2.5 times higher than that of alumina. Russia has pioneered the processing of this raw material into alumina. Continuous improvement of the technology by RUSAL is creating the possibility to widen the existing raw material base by including aluminosilicate raw materials with lower alumina content of which there are huge resources globally.

2. Nepheline Syenite Raw Material Base Review

Igneous Nepheline rocks vary greatly in structural features, the presence of secondary elements, and quantitative interrelation between coloured and colourless components (theralites, nepheline syenite, miaskites, maripolites etc.). The most industrially important are the nepheline syenite, ijolite and urtite ores.