AKW Equipment + Process Design
Expertise in Alumina Refineries

Thomas Baumann
Head of Technical Sales Engineering
AKW Apparate + Verfahren GmbH, Hirschau, Germany
Corresponding author: tbaumann@akwauv.com

Abstract

As the Bauxite and Alumina industry currently face important market challenges, a key objective is to improve and optimize the overall process chain, from bauxite mining and processing through to the refinery and smelter process. Since 1978, AKW Equipment + Process Design delivered more than 50 projects in alumina refineries. There, AKW A+V hydrocyclones AKA-VORTEX and distributors AKA-SPIDER have been operating successfully for several decades. For the special conditions of hot caustic soda, AKW Equipment + Process Design proprietary polyurethane hydrocyclones are also used with great success, contributing to significant cost savings without compromising process performance. Beside this traditional approach, AKW Equipment + Process Design recently introduced its unique twin hydrocyclone concept for alumina classification. Also made of our proprietary polyurethane, this newly introduced system is capable of delivering further cost savings, especially through smaller footprint and easier maintenance. An explanation of the installation and operation of such alumina clusters in a refinery will be shown as an example.

Keywords: Alumina refinery; alumina classification; twin hydrocyclones; annular distributor.

1. Introduction

Alumina is usually produced from bauxite in the well-established Bayer process. This process utilizes the thermodynamic properties of the caustic soda-aluminum hydroxide system. In the Bayer process, a caustic soda liquor flows in a circuit which is fed with ground bauxite and then heated to digestion temperature. The bauxite’s alumina minerals dissolve at the elevated temperatures and pressures in the digesters. Afterwards, the undissolved material from the bauxite, i.e. the bauxite residue or red mud, is removed from the process by means of thickeners and/or filters. The supersaturated liquor is then cooled to induce crystallization. To accelerate the precipitation process to commercially feasible rates, previously precipitated alumina trihydrate (fine seed, coarse seed) is added to the pregnant liquor to improve the crystallization rate and product quality. At the end of the precipitation process, alumina tri-hydrate can be separated by hydrocyclones into product, fine and coarse seed and de-liquored by filters. In a last process step, the aluminum hydroxide is converted to alumina by calcination. [1, 2]

The “all time modern process philosophy” can be summarized in the following manner:

- decreasing of energy consumption by improvement of liquor productivity;
- decreasing of Al-hydrate losses;
- increasing the particle strength of alumina;
- improving alumina handling,
- minimizing the environmental impact;

It has to be taken into account that the Bayer process is constantly evolving and the specific techniques employed in this highly sophisticated industry for the various steps of the process do vary from refinery to refinery. Always however, alumina tri-hydrate crystal formation (the nucleation and growth of alumina tri-hydrate crystals), and the precipitation and collection