Simulation of Cement Grinding Circuits by BMCS

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ABSTRACT

More than 60% of electric energy consumption of cement factories is used to grind raw materials and clinker. Due to such a high level of energy consumption, implementation of optimization studies is reasonable. Most of installed cement grinding circuits are composed by a multi-compartment tube mill in an open circuit or a closed circuit with an air separator. In the present article, simulation of these cement grinding circuits is discussed using BMCS; the Ball Milling Circuits Simulator. BMCS software is able to simulate ball mills, hydrocyclones, efficiency curve, stream splitting and junction points, and convergence of closed circuits. In this article, BMCS's ball mill module is used for simulating compartments of a tube mill, and the efficiency curve module (ECS) is used to simulate an air separator and the diaphragm between the two compartments. BMCS takes advantage of population balance method and Weller's RTD modeling for simulation of ball mills, and Whitten's relationship to simulate efficiency curve.

Keywords: cement grinding, simulation, BMCS, modeling, multi-compartment tube mill, air separator

INTRODUCTION

About 2% of world's energy consumption is absorbed by cement factories, and about a 40% fraction of this amount is consumed for grinding of clinker and a 20% fraction for raw material grinding. According to such a high energy consumption, efficiency drop in this grinding circuits leads to a considerable increase in production expenses. Vice versa, a significant decrease in production expenses is accessible by a few percents increase in grinding circuit's efficiency. Moreover, optimization of grinding circuits may improve the quality of the product. Therefore, optimization of cement grinding circuits – especially in old factories – gets a high rate of importance because of its effect on lower energy loss and higher product quality. Up to now in Iran no report is released about implementation of any optimization studies based on process simulation technology on cement grinding circuits.
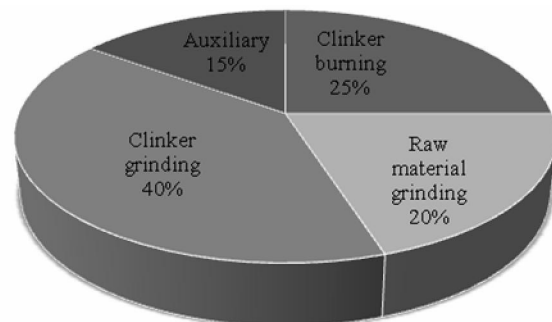

Fig. 1: Energy distribution among cement manufacturing plant

Simulation of grinding circuits at steady state which is done based on validated mathematical models is a scientific tool for optimization of circuits. Nowadays, it is impossible to optimize grinding circuits or prepare an optimum design without using simulation tools. In this article, computer simulation of cement grinding circuits is done via BMCS simulator.

ABOUT "BMCS"

BMCS – Ball Milling Circuits Simulator – (Farzanegan,1998) is a sequential simulator which primarily developed for simulation of closed ball milling circuits. BMCS version 2 (Valian and Farzanegan, 2010) is able to simulate any circuit