GRINDING FROM THE
MATHEMATICAL POINT OF VIEW

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Abstract

A rigorous mathematical description of grinding processes used in powder technologies is developed. A grinding equation, an operator equation, connecting the final particle size distribution function to the particle size distribution function before the grinding process is studied. The mathematical model introduced here can be used to predict the results of grinding, to construct grinding systems with desired properties, and to improve the particle size measurement.

Keywords: Grinding equation, Operator equation, Particle size distribution function.

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1. Introduction

Powder technologies have many industrial applications in powder coating [5] and pharmaceutics [6], for example. The powder production is based on the use of special grinding systems [3]. The aim of this work is to develop a rigorous mathematical description of grinding processes.

Any grinding system contains grinders and classifiers. The grinder is responsible for the particle size reduction and the classifier separates small particles and takes them out from the grinder. These two principal elements of grinding systems can be described in terms of operators defined in spaces of particle size distribution functions. This allows to derive a grinding equation, an operator equation, connecting the grinding system ‘output’, the final particle size distribution, to the ‘input’, the particle size distribution before the grinding process. This mathematical model can be used to predict the results of grinding, to construct grinding systems with desired properties, and to improve the particle size measurement.

The paper is organized as follows. In the second section an informal outline of the approach is presented. The third section is devoted to geometric partition models and