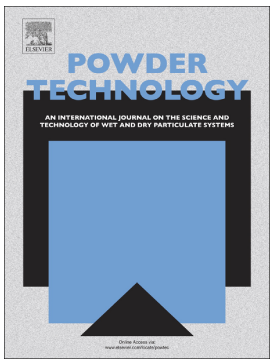

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A Numerical approach for the evaluation of particle-induced erosion in an Abrasive Waterjet focusing tube

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Abstract

In this work, a numerical approach to study erosion phenomena inside a focusing tube for Abrasive Water Jet (AWJ) is presented. The goal of this approach is to capture the erosive action of the particle-laden flow developing inside the focusing tube as a result of cumulated impact phenomena. This is fundamental in the research and development of this sector in order to optimize cost and reliability of the AWJ system. With this purpose, a multiscale algorithm for CFD-DEM is used in combination with erosion models presented in the literature so to retrieve erosion profiles comparable to the one obtained by the most common experiments in this field. The approach is shown to provide insight into the process of wear development as the identification of areas characterized by brittle and cut phenomena. Preliminary parametric studies on the influence of impact models and particle diameters are proposed to show the potentialities of the method in describing the physics of the nozzle.

1. Introduction

An Abrasive Water Jet (AWJ) system is characterized by a high-velocity waterjet that, passing through a mixing chamber produces a partial vacuum by venturi effect, and entrains abrasive particles coming from a hopper. The resulting three-phase flow jet consisting of water, entrained air, and accelerated particles is a versatile tool able to cut a widespread range of materials [1]. In [1] it was shown how abrasive waterjet cutting technology holds significant advantages over other cutting techniques since it is characterized by low cutting force and reduced thermal effects. This can positively affect the weldability of the cut material and at the same time eliminates the logistic disadvantages caused by melting and vaporization of thermally attacked working pieces.

As underlined in [2, 3, 4], the focusing tube represents a fundamental component of the AWJ system. Its primary scope is to stabilize the flow formed in the mixing chamber and create a focused and consistent, high-

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