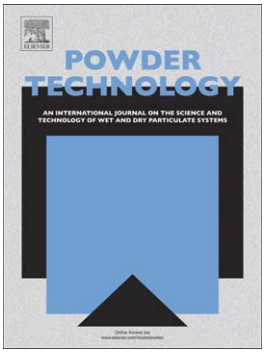

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G.H. Bagheri, C. Bonadonna, I. Manzella, P. Vonlanthen

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On the characterization of size and shape of irregular particles

GH. Bagheri[1,*], C. Bonadonna[1], I. Manzella[1], P. Vonlanthen[2]

[1]*Department of Earth Sciences, University of Geneva, Rue des Maraîchers 13, CH-1205 Geneva, Switzerland*

[2]*Institute of Earth Sciences, University of Lausanne, UNIL-Mouline, Building Géopolis, CH-1015 Lausanne, Switzerland*

Abstract

The size and shape characterization of irregular particles is a key issue in many fields of science, which is often associated with large uncertainties. We assess existing protocols and introduce new strategies for the study of size and shape of irregular particles by performing a comprehensive characterization of 127 volcanic clasts with diameters between 155 μm and 37 *mm*. Methods include caliper measurements, image analysis, laser scanning and scanning electron microscope micro-computed tomography. Volume, surface area and various shape descriptors including form factors (e.g. flatness, elongation), circularity measures and sphericity are analyzed. First, existing procedures commonly applied by caliper and image analysis to determine 1D (i.e. particle lengths in three dimensions) and 2D variables (e.g. particle projection perimeter and area) have been revised. A new procedure based on particle projection area (PA protocol) for measuring particle lengths in three dimensions is also proposed that is associated with the lowest operator-related errors with respect to existing protocols. In addition, the effect of number of particle projections on the variables obtained through image analysis is investigated. It was found that two to three perpendicular projections can be used to characterize 2D variables with a maximum error of <10%. Second, 1D and 2D variables calculated based on the new PA protocol and image analysis are used to derive shape descriptors and investigate their variability and correlations. Finally, both

* *Corresponding author. Address: Department of Earth Sciences, University of Geneva, Rue des Maraîchers 13, CH-1205 Geneva, Switzerland. Tel.: +41 22 379 6660, E-mail: gholamhossein.bagheri@unige.ch*