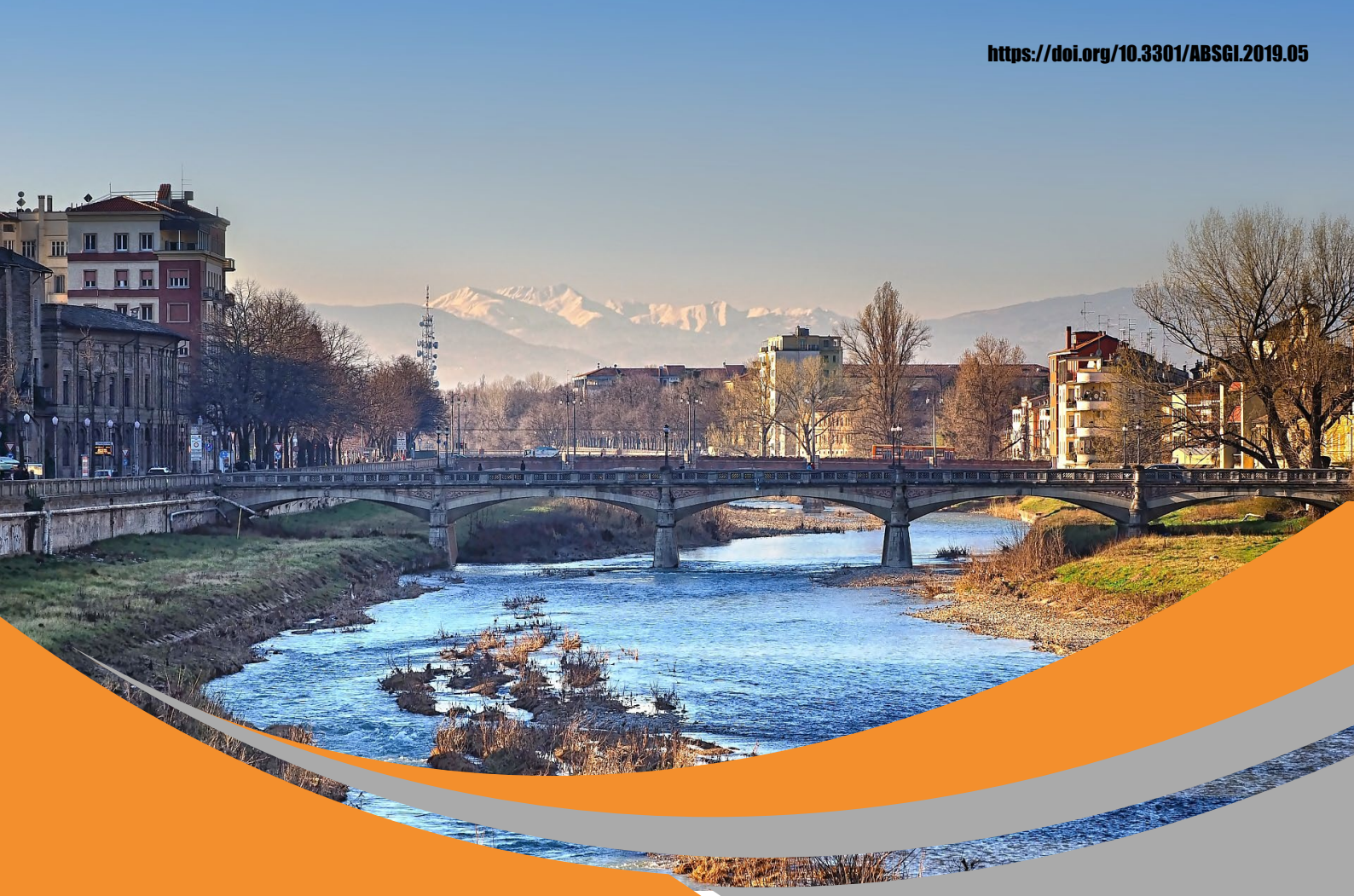
https://doi.org/10.3301/ABSGI.2019.05



Parma 16-19 settembre 2019

ABSTRACT BOOK

a cura della Società Geologica Italiana

Congresso SIMP-SGI-SOGEI 2019

Il tempo del pianeta Terra e il tempo dell'uomo: Le geoscienze fra passato e futuro

PARMA 2020 la cultura batte il tempo | CAPITALE ITALIANA DELLA CULTURA

SOCIETÀ ITALIANA DI MINERALOGIA E PETROLOGIA SIMP

SOCIETÀ GEOLOGICA ITALIANA 1881 MENTE ET MALLEO

Società Geochimica Italiana So.Ge.I.

PRESIDENTI DEL CONGRESSO

Mario Tribaudino (SIMP), Fabrizio Storti (SGI)

COMITATO SCIENTIFICO

Luca Bindi, Angelo Camerlenghi, Piergiulio Cappelletti, Fulvio Celico, Carlo Doglioni, Elisabetta Erba, Francesco Frondini, Guido Giordano, Massimo Mattei, Alessandro Pavese, Stefano Poli, Antonello Provenzale, Elisabetta Rampone, Mauro Soldati, Andrea Zanchi

COMITATO ORGANIZZATORE

Alessandra Montanini (coordinatore)
Domenico Calcaterra, Bernardo Carmina, Lorenza Fascio, Nadia Malaspina, Fabio Massimo Petti, Alessandro Zuccari

COMITATO ORGANIZZATORE LOCALE

Andrea Artoni, Fabrizio Balsamo, Luca Barchi, Danilo Bersani, Cristian Cavozzi, Alessandro Chelli, Andrea Comelli, Daniela D'Alessio, Antonietta Di Matteo, Giovanna Gianelli, Paola Iacumin, Giovanni Leonelli, Alessio Lucca, Luciana Mantovani, Paola Monegatti, Davide Peis, Emma Petrella, Davide Persico, Mattia Pizzati, Emma Salvioli Mariani, Arianna Secchiari, Enrico Selmo, Elena Turco, Roberto Valentino, Giuliana Villa

ABSTRACT BOOK EDITORS

Bernardo Carmina, Fabio Massimo Petti, Giulia Innamorati, Lorenza Fascio

Micronization of ceramic pigments: the mineralogist's viewpoint on comminution rate and amorphisation

Ardit M.*[1] & Dondi M.[2]

[1] Dipartimento di Fisica e Scienze della Terra, Università di Ferrara.
[2] CNR - ISTEC Faenza.

Corresponding email: rdtmtt@unife.it

Keywords: Ceramic pigments, Comminution, Micronization.

Since its advent (a decade ago) the Drop on Demand Ink-Jet Printing (DOD-IJP) is increasingly used worldwide to decorate ceramic tiles (Digital Decoration, DD). The introduction of this technique has forced pigment manufacturers towards a paradigm shift: the way colorants are applied onto the ceramic tiles and the technological requirements for pigments and dyes are completely changed. Indeed, the finished product is no longer a powdered colorant, but a micronized pigment dispersed in a carrier, namely an ink. Ceramic inks are produced by means of a high-energy ball milling process to reduce the particles of pigment from micrometric to submicronic size (i.e., *micronization* down to median diameters, d_{50}, of 0.2-0.5 μm). Along with several advantages (non-contact decoration, high-quality images, print on textured surfaces, less wastage of inks and additives, and no need for screens), DOD-IJP also entails strict requirements, among which ensuring that >99% of the pigment particles are less than 1 μm in diameter (Hutchings, 2010). Being mainly dependent on the specific energy input (i.e., on the energy supplied to the grinding chamber in relation to the mass of product), pigment micronization down to the requested particle size proves to be the most energy-consuming *comminution* process per unit weight of product (Wang Y. & Forssberg, 2007). It derives that comminution of ceramic pigments is a key issue for ink production, which has strong repercussions on color strength, mechanical properties and resistance to amorphization of the pigment crystal structure. Based on size-energy relationships in comminution processes, as well as on the concept of pressure-induced amorphization in crystal structures, this contribution is aimed at providing a new viewpoint on the micronization effects during the comminution of ceramic pigments.

Experimental data on the comminution of representative industrial ceramic pigments (with zircon-, rutile-, spinel-type crystal structure) as micronized in a pilot plant have been selected from literature. Besides to confirm the suitability of the Rittinger's law in the submicrometric range of particles size, the energy dissipated by the comminution process is found to be proportional to the number of iterations during the micronization. In addition, different rates of micronization of three spinel-type pigments ($CoFe_2O_4$, $CoAl_2O_4$, and $Co_{0.75}Fe_{0.75}Cr_{1.5}O_4$) point out a new relationship between grindability of a ceramic pigment and its density (or bulk modulus). A new interpretation on the degree of ceramic pigments amorphization after prolonged comminution is also conceived.

Hutchings I. (2010) - Ink-jet printing for the decoration of ceramic tiles: technology and opportunities. In: Proceedings of the 12th World Congress on Ceramic Tile Quality, QUALICER, Castellón (Spain). 1-16.

Wang Y. & Forssberg E. (2007) - Enhancement of energy efficiency for mechanical production of fine and ultra-fine particles in comminution. China Particuol., 5, 193-201.

SPONSOR

PLATINUM

GOLD

SILVER

BRONZE

PATROCINI

9 788894 022797