DESIGN OF A SENSORISED TEST BENCH FOR QUANTIFYING RCS EMISSIONS IN CERAMIC TILE CUTTING OPERATIONS

E. Monfort[(1)], A. López-Lilao[(1)], J. Soler[(2)], C. Borras[(2)]

(1) Instituto de Tecnología Cerámica (ITC). Asociación de Investigación de las Industrias Cerámicas (AICE), Universitat Jaume I. Castellón. Spain.
(2) Germans Boada S.A. Rubi, Spain

INTRODUCTION

The International Agency for Research on Cancer (IARC) has classified respirable crystalline silica (RCS) in the form of quartz or cristobalite dust as carcinogenic to humans (Group 1). In this sense, the European Union has recently included "jobs that involve exposure to respirable crystalline silica dust generated in a work process" as a carcinogen in the Directive that regulates exposure to carcinogens or mutagens at work (Directive 2019/983, which amends Directive 2004/37/EC). European companies whose operations include jobs exposed to RCS must take the necessary measures to minimise worker exposure by implementing all the available technical resources and taking extreme safety measures when those substances are being handled.

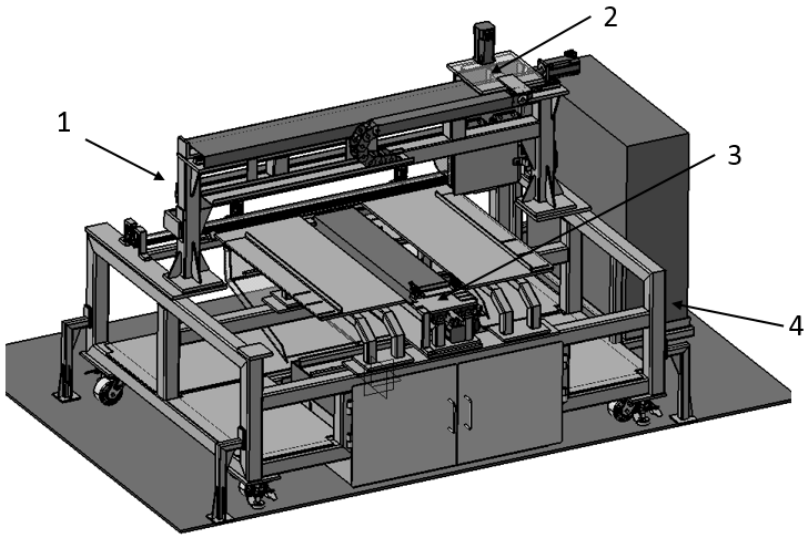
In addition to the problems associated with handling particulate materials containing respirable crystalline silica (RCS), one must also take into account the need to control exposure to RCS generated during post-processing and installation of products containing crystalline silica. In this regard, the available data indicate that jobs that involve cutting and rectifying or edge-grinding ceramic tiles are potential sources of RCS emissions.

OBJECTIVES

The general aim of the project EMICORTE (study of RCS emissions during ceramic tile cutting and rectifying or edge-grinding operations) is to develop low-RCS-emitting tools and to establish recommendations (in terms of design and use of cutting machinery) to ensure minimal exposure to RCS particles when ceramic tiles are machined.

PRELIMINARY RESULTS

In order to carry out cutting operations under controlled conditions, a prototype of an automated, sensor-controlled cutter was designed and built, which enabled the main variables in cutting operations to be monitored and recorded.



Where:
1: Module X-axis
2: Module Z-axis
3: Module Y-axis
4: Welded framework

Figure 2. *Diagram of the sensorised, automated cutting prototype*

With the aim of quantifying the RCS emissions produced during ceramic tile cutting, a wind tunnel was designed and constructed based on the principles described in standard EN 1093 (Safety of machinery. Evaluation of the emission of airborne hazardous substances). This wind tunnel enables emissions generated in different conditions to be evaluated, especially the concentration of particles in the various fractions of interest, so that worker exposure can be monitored under controlled and standardised conditions.

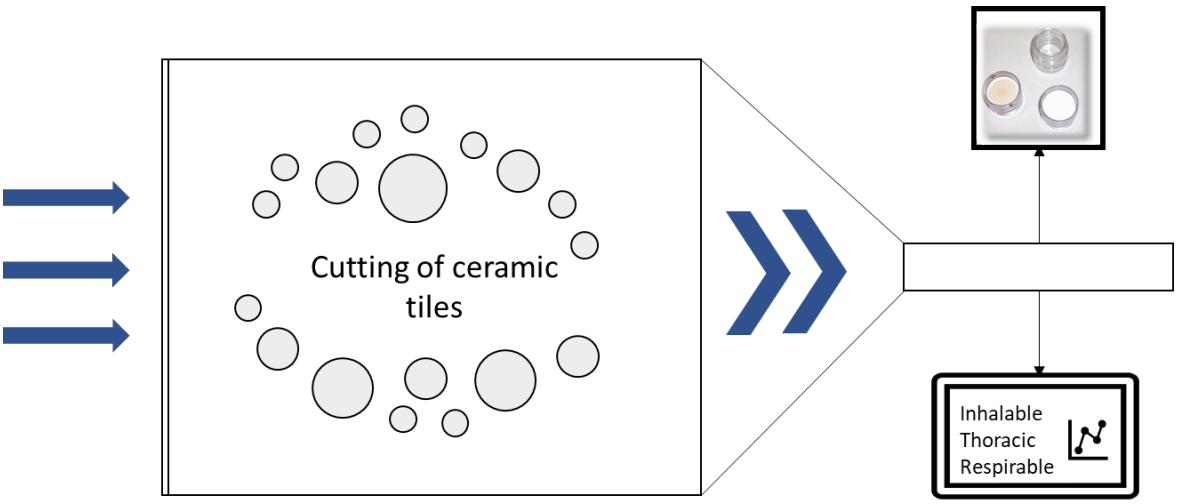


Figure 1. *Schematic illustration of the wind tunnel*

Once the two components described above (cutting prototype and wind tunnel) had been built, they were connected and the complete system validated.

Validation consisted of measuring different parameters (flowrate, pressure, etc.) in order to confirm that all parameters complied with the specifications set down in applicable standards (in regard to the wind tunnel and the various samplers of particulate matter). Subsequently, systematic tests were conducted to assess the trial's repeatability and reproducibility.

NEXT STEPS

Once the test bench has been designed, built and validated, the following steps will be taken:

- Evaluation of the influence of operating variables, product and mitigation measures on RCS generation.
- Construction of a pre-commercial prototype of a low-RCS-emitting tool.
- Preparation of good practice guides for cutting operations.

REFERENCES

[1] IARC. (1997). Silica, some silicates, coal dust and para-aramid fibrils.
[2] IARC (2012). Arsenic, Metals, Fibres, and Dusts
[3] UNE-EN 1093:1999 Seguridad de las máquinas. Valoración de la emisión de las sustancias peligrosas transportadas por el aire