SILICOAT

Industrial implementation of processes to render RCS safer in manufacturing processes

Partnership

PORTUGAL
APICER (SME-AG)

SPAIN
ASCER (SME-AG)
ATOMIZADORA (SME)
PORVASAL (SME)
ITC (RTD)

ITALY
FLAMINIA (SME)
CCB (RTD)

GERMANY
ZIEGEL (SME-AG)
BVKI (SME-AG)
WALKÜRE (SME)
ITEM (RTD)

The Consortium consists of 11 partners, comprising Smalll and Medium-size Enterprises (SMEs), SME Association/Groupings (SME-AGs), and Research and Technology Development (RTD) Centres.

The project targets the entire traditional ceramics sector, represented in the project by SMEs and SME-AGs from 4 of the main European ceramics- manufacturing countries.

Objectives

Crystalline silica is an essential raw material for the production of most of the goods used in everyday life. Hence, a vast number of European workers are potentially exposed to Respirable Crystalline Silica (RCS) at their workplace.

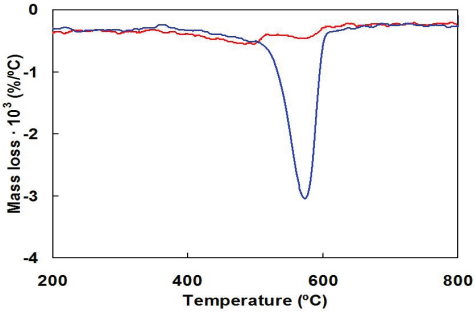
The ceramics industry is particularly concerned, since its products are based on silicates and the contain considerable amounts of quartz, which is indispensable for the manufacturing process.

However, certain substances can virtually nullify the toxicity of quartz, by coating RCS particles.

The main objective of the SILICOAT project is the industrial implementation of these substances in ceramic manufacturing processes, thus transforming quartz-containing raw materials into intrinsically safe products.

Lab studies

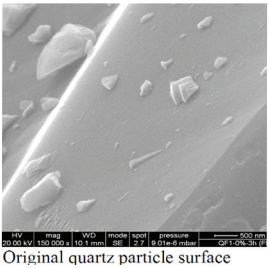
An RCS coating technology was explored for traditional ceramic sectors: red-firing porous wall tile bodies, porcelain tableware bodies, vitreous china sanitary ware, and raw glaze for porcelain tableware.



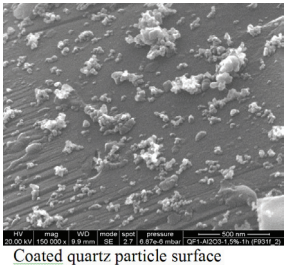
Certain instrumental technologies (TG, SEM, XPS, etc.) were used to define the best coating treatments in terms of coating agents, proportioned quantities, and reaction times, in which a balance was sought between coating quality and the cost and ease of implementation in industry.

Two organosilanes with different functional groups were chosen.

Nano-alumina was also deemed a possible additive for reducing quartz toxicity.



Original quartz particle surface



Coated quartz particle surface

Full-scale trials

Once the effectiveness of the coatings had been verified, the feasibility of the integration of these treatments in the selected ceramic processes was examined.

The technology needed for coating was quite simple, because it could be incorporated as part of existing processes. The coating treatment was fully integrated into the current manufacturing processes.

Two coating agents were used in the trials. The influence on process conditions on the main end product properties was studied, yielding satisfactory results

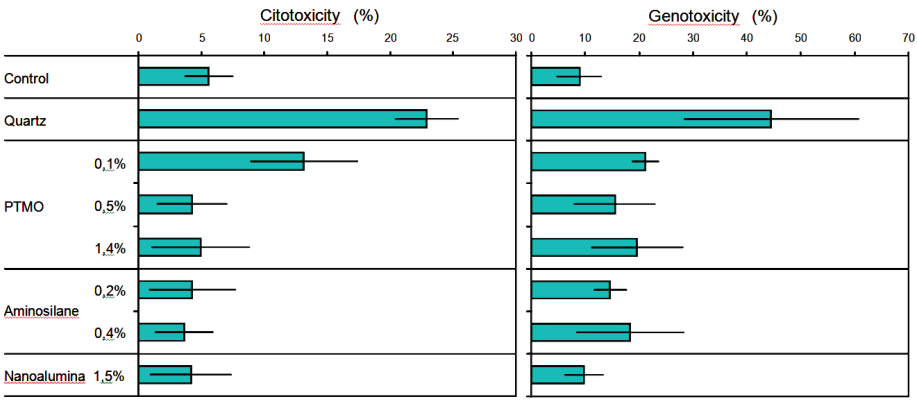
Toxicological results

In vitro

For characterisation of quartz toxicity, lactate dehydrogenase (LDH) and alkaline comet assay analyses were performed (± aluminium lactate, a quencher of quartz toxicity). After screening and identifying of the most active quartz, the protective efficiency of the coating agent candidates was studied at various concentrations. The coatings resulted in an evident reduction of quartz toxicity.

In vivo

In the rat model, *in vitro* results were validated; in addition, stability of the quartz surface coating under physiological conditions was confirmed for a mid-term perspective.



Economic impact assessment

The added cost involved in the coating treatments was calculated. This ranged from 2 to 4 € per ton of composition. For many compositions, this would involve an added cost increment of less than 3%.

Conclusions

- A coating process has been developed to render RCS safer.
- Several coating agents demonstrated their efficiency from a toxicological viewpoint.
- Good results were obtained in industrial trials at different ceramics -manufacturing companies.
- The developed process is a promising candidate for inclusion in the "NEPSI Good practices Guide"

Silicoat Partners

APICER
associação portuguesa da indústria de cerâmica

ziegel

BVKI
BUNDESVERBAND KERAMISCHE INDUSTRIE E. V.

ASCER
Asociación Española de Fabricantes de Azulejos y Pavimentos Cerámicos

porvasal

FLAMINIA.

Walküre
PORZELLANFABRIK
MADE IN GERMANY

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CENTRO CERAMICO - BOLOGNA

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