

BOLETIN DE LA SOCIEDAD ESPAÑOLA DE







Noticias, Cultura y Tecnología

Nota técnica: NEOSAWARE – Modeling Software Platform for Ceramic Body Management

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Do we have the best composition at the lowest cost? Do we make efficient data management? If a technician changes, the knowledge could be lost? Are we using the most appropriate raw materials?

For these and other questions, NeosAware has been developed. It is software based on artificial intelligence with the function of self-learning machine, in order to model the behavior of raw materials in the compositions and, in this way, to be able to deal with production problems, to simulate new compositions prior to their experimentation and optimizing compositions according to production constraints.

What are the objectives?

The initial concern was to develop a tool for use in any laboratory or research center, with a efficient information management and knowledge management, with robustness, efficiency and effectiveness of algorithms, both in the modeling of raw material behavior as well their interactions allowing the composition optimizations. Moreover, looking for use of simplicity, with developing the interface Mathematical/Ceramic Engineer based in the ceramic point of view.

What can we find in NeosAware?

NeosAware is divided into five modules: Equipment and Units. Identifies the equipment and units used in each laboratory.

- Ceramic processes. Defines the sample preparation process as well the standard processes such as: porous, gres and porcelain
- Characterization and control of raw materials.

Este proyecto ha sido premiado con un Alfa de Oro en la 41ª edición de los Premios Alfa de Oro, otorgados por la Sociedad Española de Cerámica y Vidrio durante la Feria Internacional de Cerámica de Valencia CEVISAMA 2017

- Projects, which include options to simulate compositions and optimize according to production constraints.
- Energy module. Developed by ITC, shows the differences in energy consumption of a new composition versus the current production composition, both in the spray-dryer and in the industrial kiln

What is the core of NeosAware?

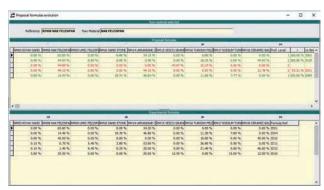
NeosAware is designed to manage information in a simple and efficient way, but its main value is in the algorithms developed by Neos. These can be divided into three typologies:

1. Algorithms for the initial proposal of formulas.

Although behavioral algorithms are based on self-learning technology, technicians may request a proposal of compositions when the project starts or a new raw material is introduced.

The objective is to obtain the maximum information with the minimum number of tests. Neos has developed a tool where initial compositions are proposed, according:

· Typology of raw materials involved.



Example of the screen of proposal formulas summary.

- Percentage range of both the raw material groups and each particular raw material.
- Temperatures or water absorptions in which the project works.
- Information from other projects or raw materials that can be used in the new development. This function allows the import of information from other projects in order to reduce laboratory tests to the minimum possible, increasing the speed of development.

2. Behavioral Algorithms.

It is the core of NeosAware. Its purpose is to know the behavior of the raw materials and their interactions with each of the properties that define the ceramic compositions. Hence, more than a hundred properties have been modeled, divided into: non-temperature dependent, dependent on the firing conditions using a fixed temperature and dependent on firing curve studying a range of water absorptions.

The research was initiated using simple mathematical resources, such as multiple regressions and other more complexes, such as evolutionary algorithms, neural networks, etc. In all cases, the data were not consistent, giving exotic results; these results have mathematical but non-ceramic sense, or did not reach enough degrees of accuracy to be acceptable to ceramic technicians. For this reason, Neos developed its own behavioral algorithms based on self-learning machines. Since it launched to the market in 2015 is reaching customer satisfaction.

The algorithm is rewritten every time new information is depending on:

- Property analyzed.
- · Units of measure used.
- Typology of raw materials.
- Interactions between known raw materials.
- Range of possible compositions.
- Range of known compositions.
- Introduced experimental data.
- In properties that depend on temperature. And their behavior is evaluated within a range of water absorptions; also the sintering curve is modeled.

3. Optimization Algorithms.

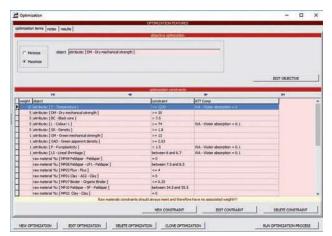
This tool is based on chains of selection algorithms developed by Neos, where millions of compositions are analyzed before presenting the optimized formula. It is designed to avoid the local optimum against the global optimum.

NeosAware in its optimization module allows the technician to define the objective functions, all constraints, attributes and raw materials of the project.

The objective function can be the maximization or minimization of an attribute or raw material. Defining restrictions are



Example of the screen to analysis the accuracy of the data.



Example of the screen where the constraints for optimization are collected

performed in a simple way, where the technician can determine the weight of each of them in the calculation of the optimal composition.

What advantages do we have when we use NeosAware?

- We create knowledge within our company. This learning is continues over time.
- Facilitates the characterization and control of raw materials and production compositions.
- Performance and optimization algorithms have been developed and are in operation in ceramic companies around the world, offering efficiency and effectiveness in their results.
- It allows simulating compositions using a very small number
 of tests, seeking maximum efficiency in laboratory work. In
 addition, it is possible to import information between different projects, in order to increase the speed in the development of projects or in the resolution of productive problems.
- It allows us to optimize our compositions at the lowest cost, attending to an unlimited number of production restrictions.
- Aids the development of innovative compositions "Thinking outside the box".
- It gives us a global vision of composition within our company, from a financial, technical or energetic point of view.

It gives us a global vision of ceramic body formulation within our company, from a financial, technical or energetic point of view.

Who are using NeosAware?

Since the beginning of its commercialization, two years ago, they are using companies of all kinds of sizes around the world, which have a body composition preparation plant. In addition, mining companies are utilizing it to increase the add value of their raw materials.

For more information visit our website: www.neos-ceramics.

This work was financed in its theoretical part by the CDTI in the project titled: "MODELIZATION OF CERAMIC PASTES AND STUDY OF INTERACTIONS BETWEEN THE RAW MATERIALS" developed during 2012-2014.