

NON-DESTRUCTIVE HUMIDITY MEASUREMENT IN MATERIALS

An innovative, non-destructive method for measuring humidity in bulk materials. The invention has major potential applications in a variety of industrial sectors, in particular construction, biomass (fuelwood) and agriculture.

Context

In the construction industry, surface-covering products are often applied on some construction works made of mortar or concrete (*e.g.* concrete slab, mortar screed). Before applying such products, it is essential to control the residual humidity level of the underlying material, to ensure that the duration of the drying phase (a few days to a few weeks) is sufficient. Current methods used to measure the humidity level in mortar or concrete present many disadvantages.

Some of these methods are destructive; they imply the collection of samples, a lengthy intervention of a qualified technician and they are not adapted to assess humidity inside a material. Non-destructive methods exist but they are not entirely reliable nor satisfying. Humidity level is measured at the surface of the material and the surface of mortar or concrete dries more quickly than the heart of the material. Measurements of humidity inside the mortar or concrete are possible but the methods are complex and comprise the integration of loggers in the material. Measurements are not reliable and miniaturized loggers have a low action area. Non-destructive measurements are thus not satisfactory especially in regards to costs and accuracy.

In conclusion, current methods have many disadvantages. As a result, the construction industry, especially the building industry, increase the global length of the construction work to leave a safety margin for the drying process, which causes significant increase in costs.

Other industrial sectors such as biomass (fuelwood) and agriculture, that require the humidity control of large volumes of materials (wooden fuel chips, grain silos...) could benefit from this new, cost-effective technology.

Invention description

The present invention is a method for the non-destructive measurement of the humidity level of a material which comprises 4 steps. First, a radiofrequency signal is emitted to an antenna embedded in the material. A reflected signal is subsequently received from the antenna and analyzed to determine its resonant frequencies. Finally, the degree of humidity of the material is estimated based upon the determined resonant frequencies. The system comprises a measurement device such as a reflectometer, a very low cost antenna embedded in the material and an interface between the antenna and the measurement device. This method allows a precise analysis of the level of humidity and the progress of drying of a material.

Added value

The invention proposes a solution to measure the humidity level at the heart of a material that is non-destructive, rapid, simple, cost-effective, accurate and that does not require the intervention of a qualified technician.

The method can be used to measure the humidity level of solid materials that comprise one or more mineral binders, natural soil, solid materials free of mineral binder and containing one or more organic binders, composite solid material, powder material, wood (*e.g.* woodchips, granules, plates) and liquid material.

Potential market

This innovative technology has major potential impact in all industries that require the measurement of the humidity level of a large volume of material. It can be applied in particular in the construction industry; the operator can measure rapidly, and as many times as required, the humidity level in a material such as mortar or concrete. The proposed invention thus enables the optimization of drying time, with significant gains in construction time and costs.

Besides, this invention can also be used in the biomass sector, *e.g.* to measure the humidity level of wood chips at production or before combustion. It also has application in the agriculture sector, *e.g.* for measurements inside grain silos.

Keywords

Water content, moisture, humidity level, antenna, radiofrequency signal, resonant frequencies, construction, materials analysis, biomass, storage

Technology domain

Materials analysis, measurements, instrumentation, construction

Intellectual property

Patents:

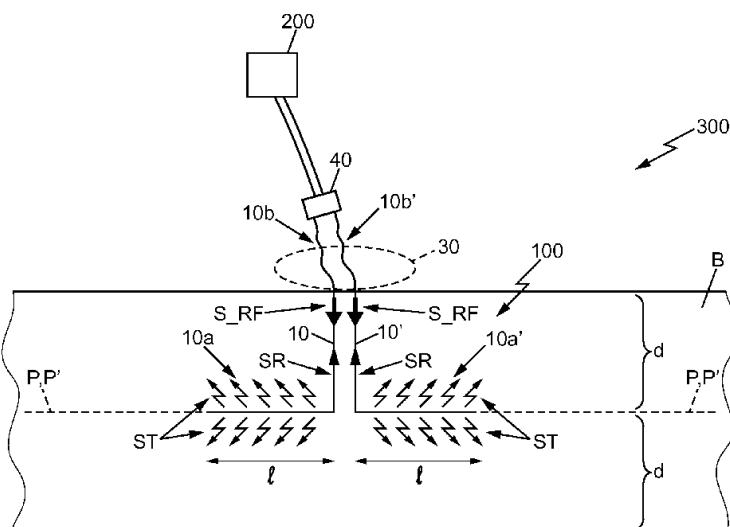
FR3033644 (granted)

WO2016142634 (pending)

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Technology transfer contact

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System with a measurement device like a reflectometer connected to a bipolar antenna embedded in a mortar screed