LEONARDO

PATENT BROCHURE

MEASURING ABSORBED HUMIDITY IN A COMPOSITE MATERIAL

Main Technological Area ⟶ Materials | Sensors

Keyword ⟶ hygroscopic | humidity | honeycomb structure| polymer | composite

Usually, plastic and composite materials are used in situations of exposure to atmospheric agents (like moisture or water) or other chemical substances; this can cause a rapid variation of the mechanical properties. To contrast these effects it is necessary to empower polymers using stabilizing substances. However, sometimes it is necessary to keep under control the results of the action of atmospheric agents in operating conditions, without dismounting any structures and put them in a lab. For this purpose, the patented solution provides a way for the measurement of the internal humidity of composite material.

Figure 1 – A composite structure

TECHNICAL SPECIFICATIONS

When a polymer is exposed to water or a humid environment, the water is absorbed until it reaches a percentage content Δweight/weight of water at equilibrium, depending both on the nature of the polymer and on environmental humidity. The absorbed water produces a plasticization effect (lowering of elastic modules, plastic flow point, glass transition temperature). The effect of plasticization is similar to that of lowering the temperature. The kinetics of water absorption are typically controlled by diffusion (Fick's Law).

The polymeric materials are brought into equilibrium with the environment, and in equilibrium conditions the moisture content in the composite is proportional to the environmental humidity. If a cavity is created inside the composite that is not isolated from the composite itself, the percentage of humidity in the cavity will be in equilibrium with that of the composite surfaces facing it. The process involves the positioning of an environmental humidity sensor in the cavity created between different layers of composite material, without compromising the mechanical characteristics of the final structure.

INNOVATIONS/ADVANTAGES

a) Certification process of the structures under conditions more advantageous than performing in-lab measurements
b) Scalability of the solution for covering a more extended structure
c) Simplification, hence savings, in certification process of the structures

FIELDS OF APPLICATION

Aerostructures	Materials for aeronautical components
Building Automation	Composite floors/walls/foundation drainage system
Automotive	Car parts
Railways	Non-structural parts
Environmental sensing	Outdoor and garden structures, walls, tents

PATENT INFORMATION

Priority Date – 09/10/2012
Priority Code – TO2005A000350
IPC Codes – G01N 19/10 | G08B 21/20 | G01N 33/44

Active worldwide applications
EPO - EP1886259B1; filing date: 2013/10/9 ; grant date: 2016/09/21
National Extensions: IT/DE/ES/GB/FR

USA - US9791364B2; filing date: 2013/10/9; grant date: 2017/10/17
JAPAN - JP6309530B2; filing date2013/10/9; grant date: 2018/4/11
RUSSIA - RU2661409C2; filing date: 2013/10/9; grant date: 2018/7/6
CANADA – CA2885833C; filing date: 2013/10/9; grant date: 2019/9/10

Leonardo internal code
LDO-A497