

## System for the removal of ice from surfaces

The CSIC, in collaboration with the University of Seville, has developed a system for the removal and / or prevention of ice formation on any type of surfaces. The developed device, consisting of a piezoelectric or ferroelectric material equipped with surface electrodes, induces an energetically efficient anti-ice effect through the automatic generation of acoustic waves, either flexural or superficial, as a result of the electrical activation of the piezoelectric / ferroelectric material.

Industrial partners are being sought to collaborate through a patent licence agreement.

### *An offer for Patent Licensing*

#### Description of the technology

The ice accumulation on surfaces is a first magnitude problem in fields such as aeronautics and telecommunications. Nowadays, procedures used to avoid this ice accumulation or to promote its elimination are based on the application of antifreeze liquids, melting through the Joule effect, the use of microwaves and, in some cases, activation by ultrasounds using external applicators.

The developed technology relies on the integration of a material with piezoelectric and / or ferroelectric activity and the corresponding submillimeter electrodes onto the object to be protected. The MHz electrical activation of this system induces acoustic waves, either in the mass or on the surface of the material, providing: i) the elimination of the accumulated ice by means of its partial melting in the interface and / or ii) the prevention of ice accretion even under environmentally favorable icing conditions.

The procedure is flexible and compatible with the use of plates, sheets or "films", in this case even with their sticking adhesion and / or gluing on any type of object. The technology supports a specific surface functionalization to improve hydrophobic qualities, abrasion resistance, etc. of exposed surfaces.



The anti-ice procedure developed may be adapted to any type of object, regardless of its shape or properties (including metals, ceramics, composites or polymers), being extremely useful in fields such as aeronautics, telecommunications, the production and transportation of energy, as well as in many other industrial processes

#### Main innovations and advantages

- The developed procedure is more energy efficient than those based on the Joule effect since it requires the sole activation of the interface zone between substrate and ice and not the total fusion of this latter.
- The developed system also acts as a sensor to characterize the ice accumulated on the surface of the object to be protected.
- The device acts in a smartly way, with automatized activation and control without the need of human operator intervention.
- Unlike conventional ultrasound or microwave approaches, the developed system is integrated into the object and does not require external applicators.
- The electrodes can be made transparent, making the anti-ice system compatible with optoelectronic devices requiring to keep transparency.
- The developed anti-icing system can be removed or replaced as desired without modifying the object or substrate on which it is applied.

#### Patent Status

Spanish priority patent application suitable for international extension

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