**Ph.D. Thesis**

# Biomimetic functional surfaces with tailored wettability for water harvesting and anti-icing applications

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**Nano-Mechatronics**

**UNIVERSITY OF SCIENCE AND TECHNOLOGY**

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# Biomimetic functional surfaces with tailored wettability for water harvesting and anti-icing applications

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# ABSTRACT

# Biomimetic functional surfaces with tailored wettability for water harvesting and anti-icing applications *

Biomimetic or Biomimicry refers to an approach that imitates nature's time-proved models, elements and strategies to solve sustainability human challenges. In this study, we proposed the fabrication and investigation process on several bio-inspired functional surfaces with tunable wettability towards solving specific problems: *water harvesting* and *anti-icing*.

*Water condensation* is a phenomenon which refers to the changing physical state of a matter from gaseous into liquid phase. The simplest process can be imagined is water condensation on objects near earth's surfaces such as: fog, dew, frost, etc. In this work, we will focus on optimizing suitable surface morphology for durable and high efficiency water harvesting performance. Several geometries and surface energies will have been conducted on Aluminum (Al) plates in order to maximize harvesting efficiency.

On the other hand, *icing phenomenon* refers to a process when liquid transferring its physical state to solid phase. Ice accumulation on functional surfaces had illustrated many bizarre effects and disadvantages in aviation, industry and human activities. Several passive approaches including water

repellency, Slippery Liquid-Infused Porous Surfaces (SLIPS) and unique design structure in order to optimize anti-icing performance will be introduced throughout this study.

Totally, we propose different physicochemical processes which arm to manipulate surface wettability towards solving specific problems including water condensation and anti-icing. The understanding about mechanism and fabrication process is useful for designing water harvesting system and icephobic applications.

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# 초록