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Fabrication of Super-Hydrophobic Nanocomposite Metal Surface for Anti-Frosting

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Extended Abstract

The formation of ice by the attachment of water or steam to a specific surface in a humid environment at sub-zero temperatures is called condensation. Identification is a phenomenon that is more easily formed on metal surfaces and appears in everyday life and various industries, such as home appliances, aircraft, vehicles, and piping systems. When implantation appears on the metal surface, various problems such as reduced heat transfer, structural damage, functional degradation, and safety hazards can occur. Due to these problems, various technologies have been developed to minimize or eliminate the occurrence of implantation on the metal surface.

Among many implantation delay studies, a study on fabricating a superhydrophobic surface using aluminum anodic oxidation was examined. Studies have shown that superhydrophobic aluminum surfaces can reduce the growth rate of frost and ice crystals and retard liquid solidification [1], and the larger the contact angle between the surface and the liquid, the more effective it is in removing and preventing frost [2].

In this study, to enhance the superhydrophobic properties of the existing nanostructured metal surface, a nanocomposite metal surface was fabricated through the AAO process and the electroplating process to increase the contact angle between the surface and the liquid. The aluminum anodization process was performed by applying a voltage of 20V in 0.1M sulfuric acid electrolyte. After the anodic oxidation process, nickel was formed between the nanostructures through an electroplating process using AC. In addition, specimens were fabricated through an alumina etching process. At this time, to prevent the loss of the nickel pillar, etching was carried out leaving alumina that could act as an anchor. The experiment compared the contact angles of the aluminum surface subjected to the AAO process only, the aluminum surface subjected to the AAO process and electroplating, and the aluminum surface subjected to alumina etching. It was confirmed that the aluminum having the alumina etching process exhibited the largest contact angle. In addition, a high contact angle was confirmed on the surface where the height of the nickel pillar was high and the etching time was long.

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