Effect of physical Properties on Micro-Structured Surfaces for Hydrophilic Control

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The wettability of solid surfaces can be caused by chemical or structural effects. Property control by the former chemical effect has been applied to various products and has been put into practical use. However, it is not suitable for permanent use due to the possibility of chemical property changes over time. In other words, it is necessary to repeat the treatment again, and cost is one of the issues. For this reason, attention is being paid to the structural effects of this wettability, which are manifested by micro-structured surfaces. However, the appropriate microstructure to achieve the desired wettability is not well understood. Therefore, many studies have been carried out worldwide to control wettability, i.e. hydrophobicity and hydrophilicity, using microstructures. In this study, we focused our investigations on hydrophilicity among these properties. In this study, regular micro-structured surfaces with a regular arrangement of cylinders on a solid surface were fabricated using photolithography and reactive ion etching (RIE). The vertical tilt and height of the cylinders were adjusted by changing the RIE processing conditions using single crystal silicon and glass as working materials. The effects of these changes on hydrophilicity and droplet shape were investigated.

Single crystal silicon is widely used as a working material for microfabrication in the MEMS field. As it is also a material for semiconductor integrated circuits, it has the advantage of being readily applicable to a wide range of processing conditions. When silicon is used as die, the wettability of its microstructure can be applied to a wide range of materials. The same can be said for glass, which has a greater potential than silicon to be used directly as it is. In any case, it is very important to clarify the wettability of microstructures in different materials.

As a specific implementation method, patterning was carried out by photolithography using SU8 resist on single crystal silicon or glass substrates, and using this as a mask, a mixture of CF4 and O2 gas was used in the etching process, and etching parameters such as gas flow rate, composition ratio, pressure, time and RF power were adjusted.

Similarities and differences in fabrication methods and properties such as hydrophilicity of micro-textures on monocrystalline silicon and glass substrates were identified.

This study can serve as a bridge between previous work with single crystal silicon substrates and future investigations of micro-texturing with glass substrates. This will not only broaden the range of micro-texturing applications, but also increase the relevance and impact of ongoing research in this field.

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