**Anti-reflection Layer using Nano Structured Surface Relief Gratings for Solar Cell**

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Low-cost and high-performance anti-reflection (AR) surfaces and coatings are useful for various optical devices and displays. The basic principle of AR is that the reflected light from air-film and film-substrate interfaces must interfere destructively to pass the light transmission into the transparent substrate. In this work, we report the reduction of surface reflection losses on azobenzene containing polymer films by fabricating an AR structure with nano-structured sinusoidal or motheye surface patterns on the polymer films as shown in Figs. 1 and 2. The AR patterns were obtained by creating a region of gradually varying effective refractive index between air and the azobenzene polymer layer. That was, for AR structures, the interference patterns were created by exposing argon ion laser beams on the surface of the azobenzene polymer films [1]. The wavelength of reflected or transmitted light was dependent on the length of period of AR structure [2]. The period could be controlled by a change of angles between laser beams, which resulted in the change of the length of interference pattern.

This photo-fabricated AR structures were confirmed by measuring the AFM images as shown figures below. The anti-reflection effect was characterized using UV-Vis spectroscopy by investigating transmittance or reflectance of the structures. Electrochemical behaviors of Pt counter electrode were confirmed using a potentiostat.

The AR structure could be replicable by replica molding by incorporating elastomeric materials such as polydimethylsiloxane (PDMS) [3]. Then this AR structure was applied to the Pt counter electrode of dye-sensitized solar cell. Pt was coated on the replicated AR structure on glass. If the counter electrode reflects the visible light and transmits the infrared (IR) in the cell, the enhanced efficiency can be expected in the solar cell. This AR structure having optimized length of period resulted in the increased reflected visible light of 10 %. Pt on the counter electrode is also known to play a role of catalyst for electrochemical reactions [4]. The sinusoidal AR structure had RMS roughness of 100 times higher than non-patterned structure and so might result in the increased electrochemical reactions.

**References**

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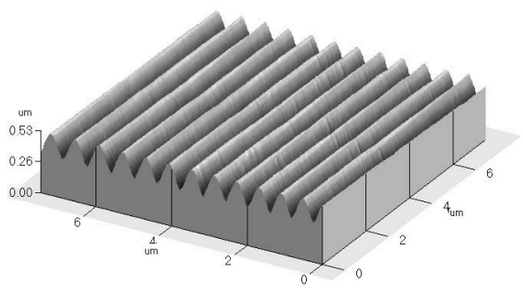


**Figure 1**. AFM Image of sinusoidal structured surface.

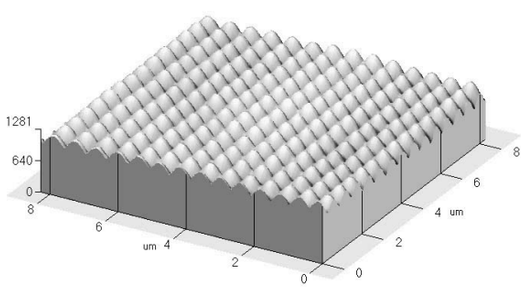


**Figure 2**. AFM Image of motheye-structured surface.