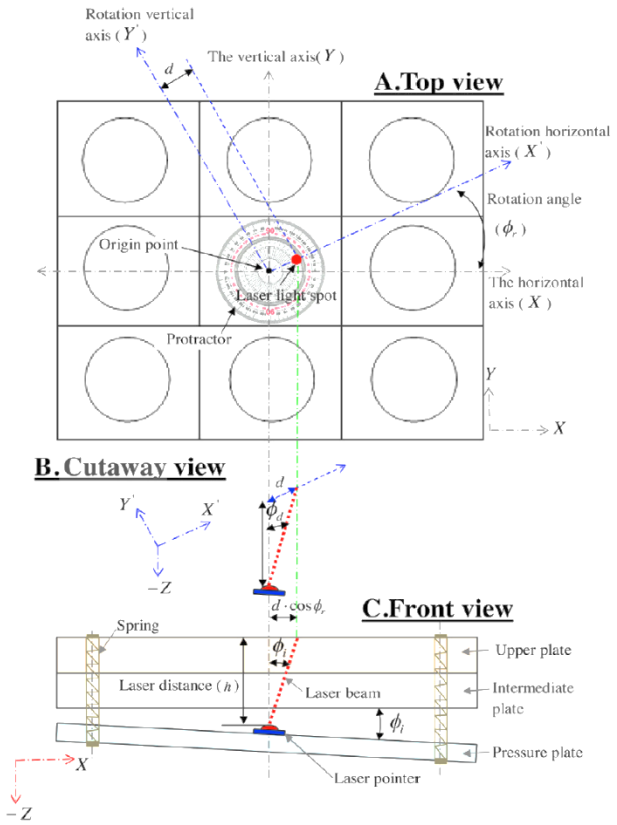
Research Highlights

Prof. Yung-Jin Weng

JOURNAL: Optik

TOPIC: Application of 9 × 9 grid gas bags pressure control technologyto imprinting of various microstructures

ABSTRACT: This study proposed a pressure control technology of 9 × 9 grid gas bags for applica-tion to imprinting of various microstructures. First, the 9 × 9 grid imprinting system wasdesigned and constructed. The novel system used laser light-emitting elements for correc-tion through geometric method before the experiment. Moreover, the proposed system canset the imprint inclined plane in small inclination angle and accurate control pressure of9 × 9 grid areas to achieve novel imprinting process of microstructures. The experimentalresults showed that 9 × 9 grid gas bag pressure control technology can accurately correctthe plane of the imprinting system before experiment, accurately set the inclined planerequired for the experiment, and accurately imprint microstructures.



Research Highlights

Prof. Yung-Jin Weng

JOURNAL: POLYMERS FOR ADVANCED TECHNOLOGIES

TOPIC: A study on the innovative microlens projection lithography applied to the production of microstructures

ABSTRACT: Microlens projection lithography is a kind of non-contact projection lithography that uses microlens array components as the projection lenses to produce a large area of microstructural array patterns on photoresisting film. This technology requires partial masking of light on the non-lens portion of the microlens array, and the conventional approach is through an aligned exposure followed by the plating process that would require accurate positioning equipment, so it is naturally time-consuming as well as costly in terms of the entire production process. This study applies an innovative technology in the production process that uses a microcircular-hole array to penetrate a stainless-steel substrate as the mold, and in collaboration with gas-assisted thermal pressuring production process that utilizes surface tension of the plastic film to fabricate the hemisphere-shaped plastic microlens array that is capable of masking light as the projection lens. With such a lens, in collaboration with optic expansion film, Fresnel lens, and millimeter-grade single-pattern photomasks, the microlens array projection lithographical optical system is constructed. Using regular millimeter-grade photomasks, a micrometer-grade array pattern is successfully fabricated on the photoresist layer through the process of projection exposure and development using such a microlens array projection lithographical optical system.

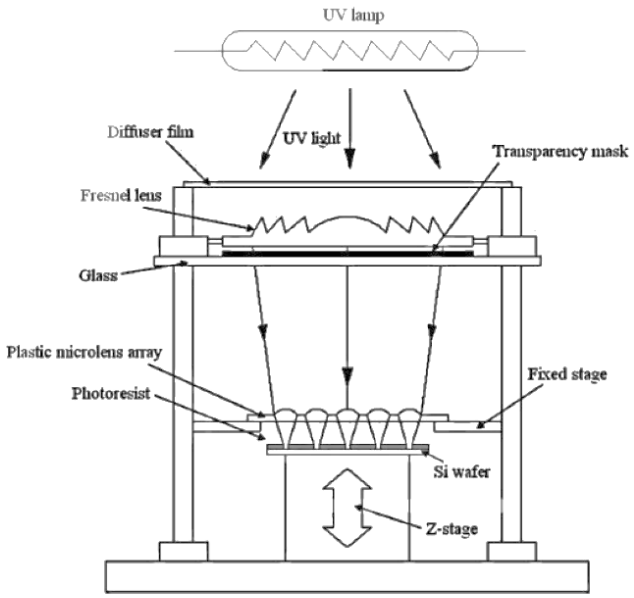


Figure 4. The blueprint of the new photomasking microlens array.

Research Highlights

Prof. Yung-Jin Weng

JOURNAL: Processes

TOPIC: A Novel Continuous Roll-Forming Process of Elastomer Molds

ABSTRACT: This study proposed a novel continuous roll-forming process of elastomer molds, which can control the deformation of the mold using the rolling belt stack combination method. This study analyzed various rolling belt combinations, assembled the system based on simulation and experimental data according to the deformation requirement design, and obtained a controllable microstructure mold rolling belt with tensile deformation. Mold thickness and microstructure size are key microstructure mold deformation parameters. This study designed and assembled a controllable microstructure mold rolling belt-type imprint molding system and conducted a series of experiments. The impact and application of different experimental system operation procedures and fabrication methods of the auxetic structure rolling belt on replication molding were analyzed. The innovative controllable microstructure mold rolling belt-type imprint replication molding technique proposed in this study had a stable and controllable mold deformation mechanism. It can control and replicate molding.

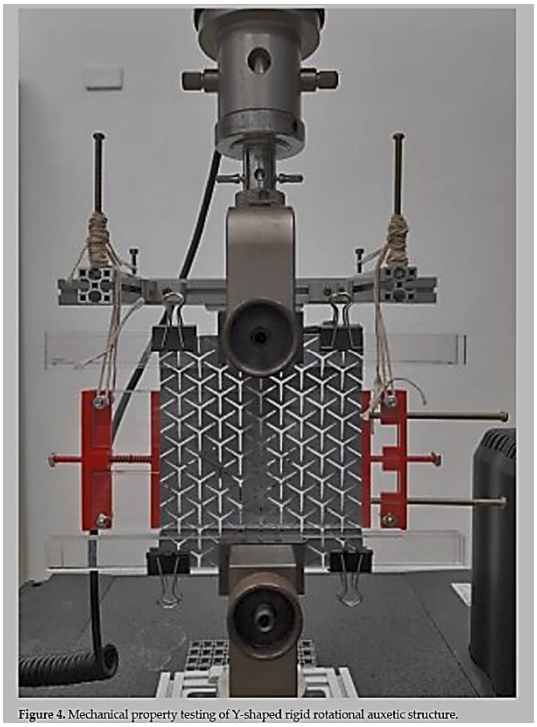
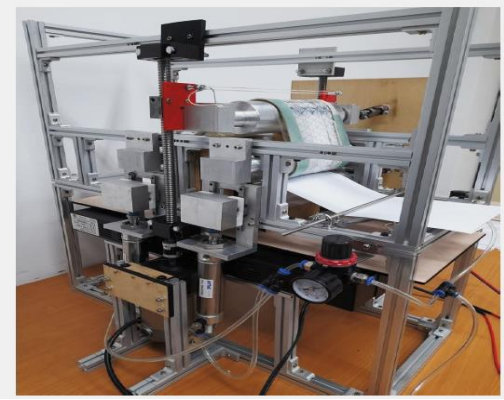
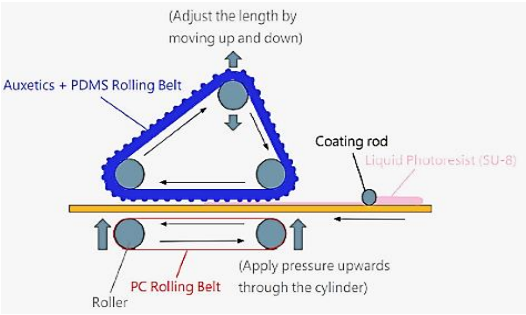


Figure 4. Mechanical property testing of Y-shaped rigid rotational auxetic structure.





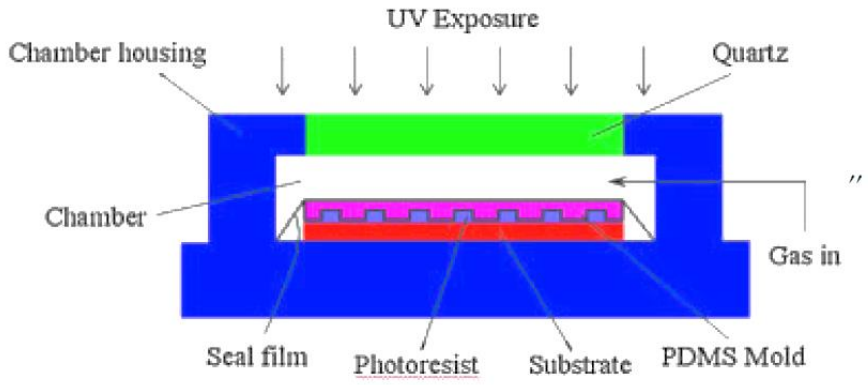
Research Highlights

Prof. Yung-Jin Weng

JOURNAL: POLYMERS FOR ADVANCED TECHNOLOGIES

TOPIC: A Study on the Dynamic Forming Mechanism Development of the Negative Poisson's Ratio Elastomer Molds—Plate to Plate (P2P) Forming Process

ABSTRACT: In this study, we try to discuss the formation defects found in the application of air-assisted soft mold UV-cured nano imprint lithography technology in the manufacture of optical waveguide devices, and find a solution. Meanwhile, we try to utilize the nano-indentation technology in the material quality detection for optical waveguide devices. The results tell us that there is a corresponding relationship between the indentation hardness and procedure parameters under nano-meter level depth. For example, the indentation tends to be harder when it is lowly loaded and shallow in depth. Closer it gets to the edge of waveguide's turning, lower the indentation hardness will be. At the same time, different exposal process results in different structural intensity. Therefore, the high structural intensity without forming defects of optical waveguide with less optical loss and better optical transmission.



Research Highlights

Prof. Yung-Jin Weng

JOURNAL: Polymers

TOPIC: A Study on the Dynamic Forming Mechanism Development of the Negative Poisson's Ratio Elastomer Molds—Plate to Plate (P2P) Forming Process

ABSTRACT: This study proposed a dynamic forming mechanism development of the negative Poisson's ratio elastomer molds—plate to plate (P2P) forming process. To dynamically stretch molds and control the microstructural shape, the proposal is committed to using the NPR structure as a regulatory mechanism. The NPR structural and dynamic parallel NPR-molds to control microstructure mold-cores were simulated and analyzed. ANSYS and MATLAB were used to simulate and predict dynamic NPR embossing replication. The hot-embossing and UV-curing dynamic NPR P2P-forming systems are designed and developed for verification. The results illustrated that the dynamic forming mechanism of the negative Poisson's ratio elastomer molds proposed by this study can effectively control microstructure molds. This can effectively predict and calculate the geometrical characteristics of the microstructures after embossing. The multi-directional dynamic NPR microstructural replication process can accurately transfer microstructures and provide high transfer rate-replication characteristics.

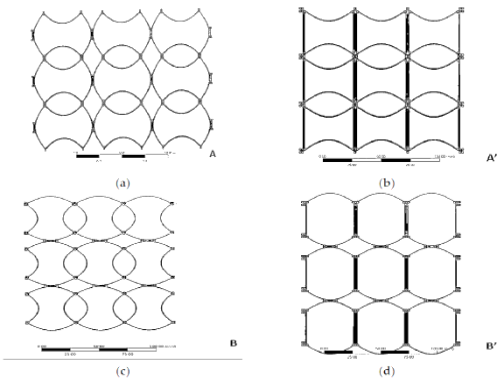


Figure 10. 3 × 3 SIN waveforms: (a) A, (b) A′, (c) B, (d) B′, types.

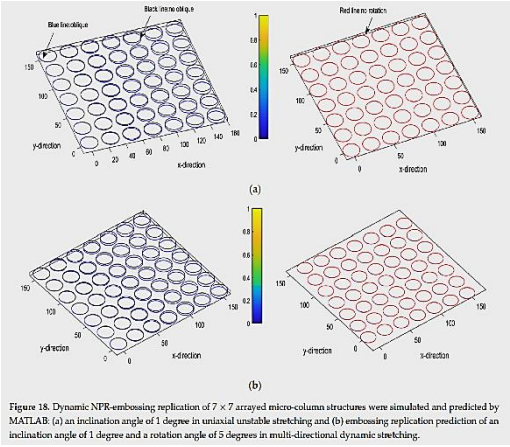


Figure 18. Dynamic NPR-embossing replication of 7 × 7 arrayed micro-column structures were simulated and predicted by MATLAB: (a) an inclination angle of 1 degree in uniaxial unstable stretching and (b) embossing replication prediction of an inclination angle of 1 degree and a rotation angle of 5 degrees in multi-directional dynamic stretching.

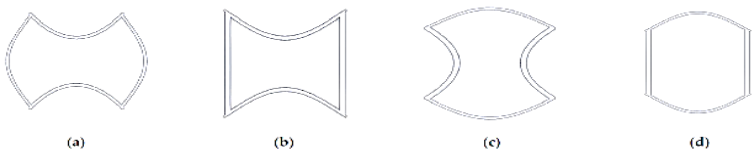


Figure 8. SIN waveforms: (a) A, (b) A′, (c) B, and (d) B′ types.