

## Molding multi-layered precise structures widely and seamlessly

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### 【Outline of survey】

In order to manufacture an optical element for the display which functions to adjust brightness, polarization, color, view angle and so on, our project proposes to mold multi-layered precise structures widely and seamlessly. The structure, for examples, has a 10-layered, 100nm pitch, 3D-mosaic structure on a square sheet with a 2 meters side. The project will develop the following reproduction technology: (a) a roll or broach shaped mold that makes a linear, not facial, contact area between the mold and a reproduced raw sheet, and (b) a "repeated deposit-press mechanism" where the structure is repeatedly pressed with the precise mosaic mold after depositing a raw material thin-layer, or a "mosaic shearing mechanism" where the multi-layered reproduced sheet is sheared at a 1-layer step using the precise mosaic mold. MEMS (Micro Electro Mechanical Systems) or nano-imprinting technology, which had been researched since 1990 in the world, presented to make only the precise reproduced structure, not a multi-layered wide one yet.

### 【Expected results】

Through the execution of the project, the optical element with the multi-layered precise structures on the wide area will be realized using the developed molds. Moreover, the developed basic technologies will be applied into any reproduction processes; the process will be optimized using micro sensors or actuators that control the physical phenomena in the sub-micron sized space near reproduced structures; the elastic molds will be developed to reproduce the sub-micron sized structure even if the sub-micron thick gap between the mold and the sheet is locally generated; the optical performance will be simulated using the reproduced precise shape.

### 【References by the principal investigator】

- Design and prototyping of Stark atom chip for electric trapping of laser-cooled atoms, Keisuke Nagato, Takeshi Ooi, Tetsuo Kishimoto, Hidekazu Hachisu, Hidetoshi Katori, Masayuki Nakao, Precision Engineering 30, pp. 387-395, 2006
- Heat Transfer in Injection Molding for Reproduction of Sub-micron Sized Features, M. Nakao, K. Tsuchiya, T. Sadamitsu, Y. Ichikohara, T. Ohba, T. Ooi, 4th International Conference on Manufacturing Research (ICMR 2006), pp. 397-402, 2006

【Term of project】 FY2007—2011

【Budget allocation】 32,900,000 yen

(2007 direct cost)

【Homepage address】

<http://hockey.t.u-tokyo.ac.jp/>