



Fig.5 Triangular grooves formed through polystyrene injection molding

specific parts of the DNA, then a DNA strand is handled briefly relying on the fluorescent light. This type of microassembly can be achieved with the proper micro-tools.

Next, I will describe reproduction assembly. Fig. 4 shows an L-letter patterned groove having a width of $20\mu\text{m}$ and a depth of $2\mu\text{m}$ that is reproduced by press-molding on glass. After masking a carbide die with resist, the die is formed by blasting and reproduced to the glass under a temperature of 530°C . Fig. 5 shows triangular grooves formed at a pitch of $1\mu\text{m}$ by injection molding on plastic. To obtain an accurate reproduction, we

pressed only on the core portion of the triangular groove twice using a piezo element. Hence, it is possible to accurately reproduce a micro-shape, such as a groove, up to about a 30-nm width.

However, the problem is attempting to reproduce a workpiece several millimeters square without bending the workpiece. Wavefront aberrations are a problem in optics. For example, a 20-nm flatness and parallelism is necessary in a 2-mm square diffraction grating. In this case, it is not enough simply to create the micro-shape of the die, but also it is necessary to analyze physical phenomena that occur during the reproduction and to control cooling and the distribution of pressure and deformation to prevent residual stress.

In addition to assembly and reproduction, other general methods of shape formation include removal, addition, and deformation. I believe that methods of shape formation, such as "growth" known in reproductive medicine will emerge from nanotechnology in the future. At that time, we will be able to produce anything by preparing the proper DNA father and culture medium mother. Perhaps this is what has conventional designers paralyzed with fear.

— MMC Activities —

The 7th International Micromachine Symposium

The 7th International Micromachine Symposium was held at the Science Museum in Kitanomaru Park, Tokyo, on October 31 and November 1, 2001.

On the first day, the symposium program began with an opening address by Mr. Toshiro Shimoyama, Chairman of the Micromachine Center, followed by guest speeches by Mr. Iwao Okamoto, Director-General of the Manufacturing Industries Bureau, METI, and Mr. Keiichi Aoyagi, Executive Director of NEDO with words of expectation to micromachine technology and encouragement for the efforts to concerned persons.

The symposium was very successful, despite the participants from overseas were greatly reduced as a result of the September 11 terrorist attacks in New York. The venue packed with participants to almost full capacity on both days, total participants for the two-day program numbered 380, including 267 registered participants, presenters, and members of the press.

On the first day, Prof. Fumio Kodama of The University of Tokyo Research Center for Advanced Economic Engineering gave a special lecture entitled "Micromachine and Business Model," exploring the topic which is currently of greatest interest to those within the industry.

Other program items on the first day included sessions entitled "The Path to Micromachine Industries in the 21st Century," "Overseas Activities," "Innovative R&D," and "Micromachine in the Last Decade and Future Outlook". A total of 16 invited lecturers, including 4 from abroad, made presentations during these sessions.

The second day of the program began with a speech by Mr. Yukihiro Hata, Director-General of the Industrial Technology Development Department of NEDO. After this, researchers representing 23

enterprises and organizations that had participated in the "Micromachine Technology Project" (completed in March 2001) - part of the Industrial Science and Technology Frontier Program by MITI- each presented the results of their team's research results, as a summary of the project.

The scheduling and content of the presentations in this symposium were regarded highly by participants, as showed by the comments for the questionnaires submitted after the of the entire program.

The schedule for the next symposium is shown below.

The 8th International Micromachine Symposium
Period: November 14 (Thu), 2002
Place: Science Hall, the Science Museum in Kitanomaru Park, Tokyo



View of Symposium Hall