Microscope Cells Containing Multiple Micromachined Wells

The cost per cell has been reduced substantially.

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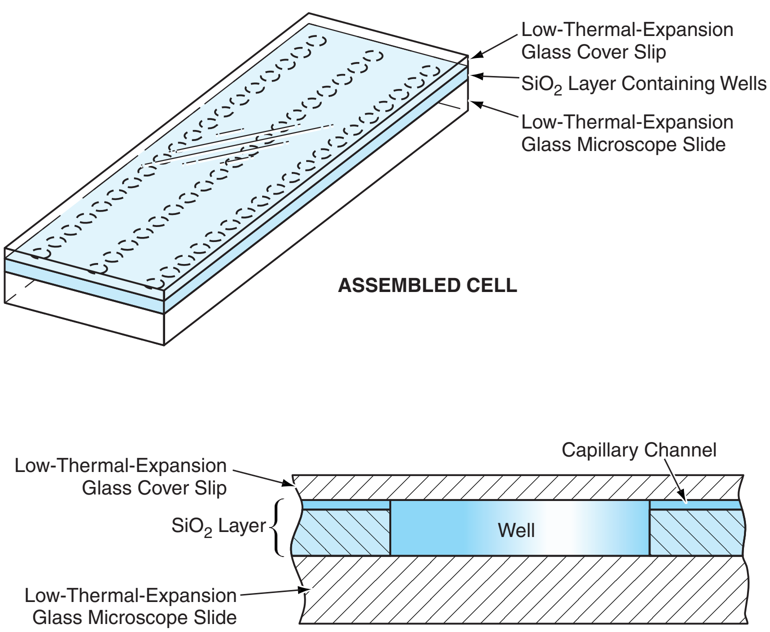
An improved design for multiple-well microscope cells and an associated improved method of fabricating them have been devised. [As used here, "well" denotes a cavity that has a volume of about 1 or 2 μL and that is used to hold a sample for examination under a microscope. As used here, "cell" denotes a laminate, based on a standard 1- by 3-in. (2.54- by 7.62-cm) microscope slide, that comprises (1) the slide as the lower layer, (2) an intermediate layer that contains holes that serve as the wells, and (3) a top layer that either consists of, or is similar to, a standard microscope-slide cover slip.] The improved design and method of fabrication make it possible to increase (relative to a prior design and method of fabrication) the number of wells per cell while reducing the fabrication loss and reducing the cost per cell to about one-tenth of the prior value.

In the prior design and method, the slide, well, and cover-slip layers were made from silicate glass. The fabrication of each cell was a labor-intensive process that included precise cutting and grinding of the glass components, fusing of the glass components, and then more grinding and polishing to obtain desired dimensions. Cells of the prior design were expensive and fragile, the rate of loss in fabrication was high, and the nature of the glass made it difficult to increase the number of cells per well. Efforts to execute alternative prior designs in plastic have not yielded satisfactory results because, for typical applications, plastics are not sufficiently thermally or chemically stable, not sufficiently optically clear, and/or not hard enough to resist scratching.



Three Layers Are Electrostatically Bonded to produce a laminated multiple-well sample cell with capillary channels for filling the wells.

The figure depicts a cell of the present improved type. The slide and cover-slip layers are made of a low-thermal-expansion glass (Pyrex™ or equivalent) and the intermediate (well layer) is made of SiO_2 — a combination of materials that results in a laminate stronger than one made from layers of silicate glass. Before the layers are assembled into the laminate, the SiO_2 layer is micromachined to form the wells plus shallow grooves that, when subsequently covered with the cover slip, become capillary channels that are used to fill the wells with samples. The micromachining is accomplished by use of the same patterning and etching techniques used to fabricate microelectromechanical systems (MEMS).

Typically the thickness of the SiO_2 layer must be made ≤200 μm — a requirement dictated by the viewing characteristics of the microscope and the nature of the microscopic examination to be performed. Prior to assembly into the laminate, the slide and cover-slip layers should be optically clear and should be polished to a tolerance tight enough to enable electrostatic bonding to the well layer.

Once the cell has been assembled, each well is filled with a sample through one of its capillary channels. Then an ultraviolet-curing epoxy is wicked into all the capillary channels, and the cell is exposed to ultraviolet light to cure the epoxy and thereby seal the samples into the wells. The cell is then ready for examination under a microscope.

This work was done by Walter Turner and Robert Skupinski of Dynacs Engineering Co., Inc., for **Glenn Research Center**. *Further information is contained in a TSP (see page 1).*

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17016.