

Preparation of Wafer-level Glass Cavities by a Low-cost Chemical Foaming Process(CFP)

—Electronic Supplementary Information(ESI)

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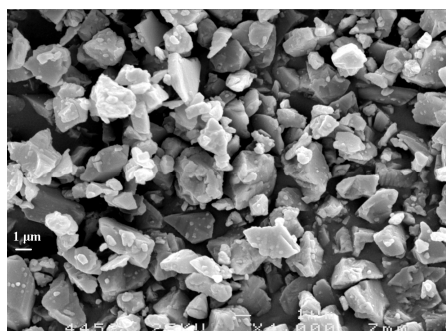


Figure E1 SEM of the titanium hydride powder used as the foaming agent in the present study. The particle size is generally smaller than 5 μm.



Figure E2 A photograph of EVG-501 bonding equipment. This is a wafer-level bonding apparatus manufactured by EVG Company. Parameters including bonding temperature, pressure, voltage and contact force for anodic bonding could be tuned at this apparatus.

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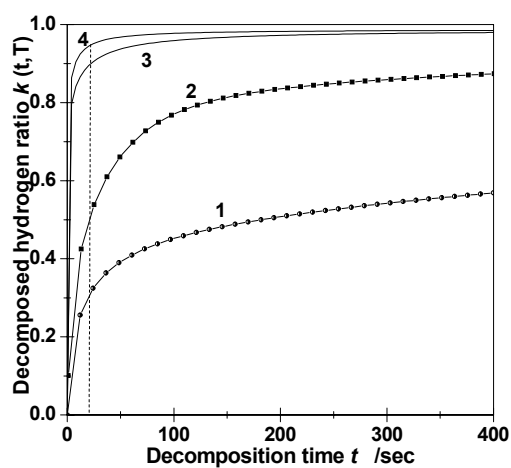


Figure E3 Thermal decomposition curves of titanium hydride. This is calculated by the thermal decomposition equations of titanium hydride, which were investigated in the leading author's previous research.²¹

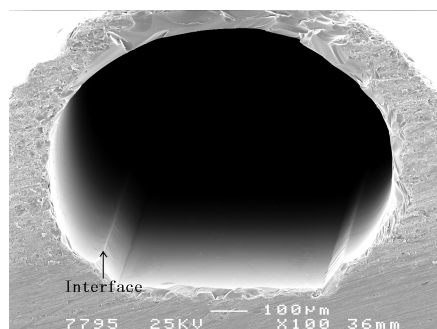
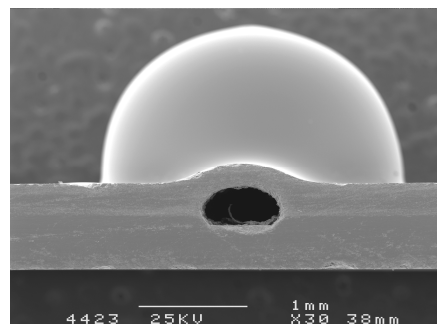
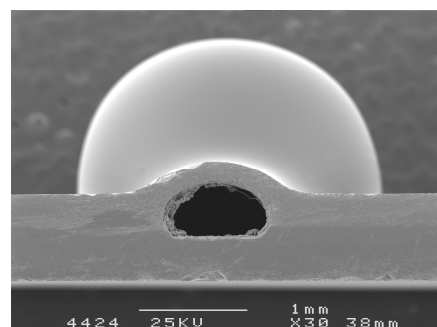


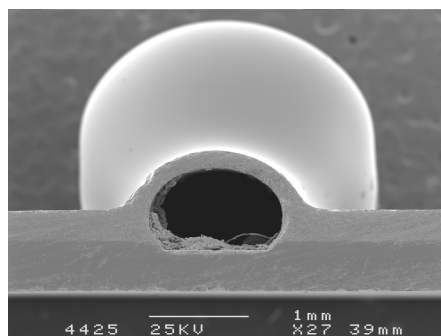
Figure E4 SEM of the further magnified cross-section of the right channel in Fig. 8. The arrow points at the interface between the glass and the silicon, which is very well bonded even after foaming.



(a)



(b)



(c)

Figure E5 SEM of glass channels of different sizes. (a) The silicon opening width is 600 μm ; (b) The silicon opening width is 800 μm ; (c) The silicon opening width is 1200 μm .

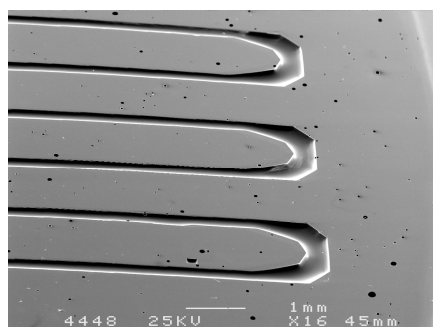
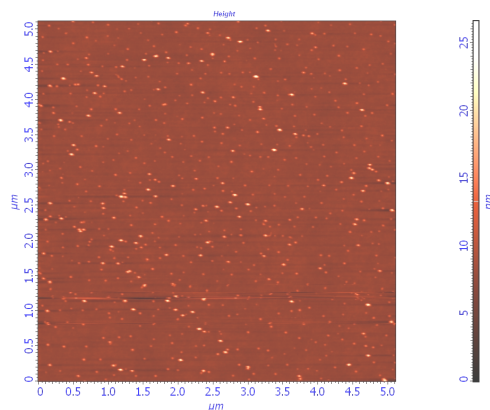
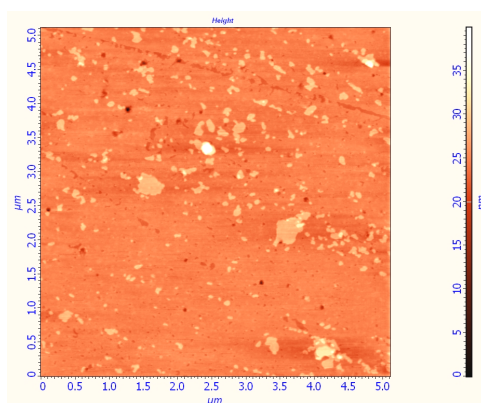


Figure E6 SEM of glass channels without silicon substrates. The silicon substrate is removed by wet etching with TMAH for 2 hours.

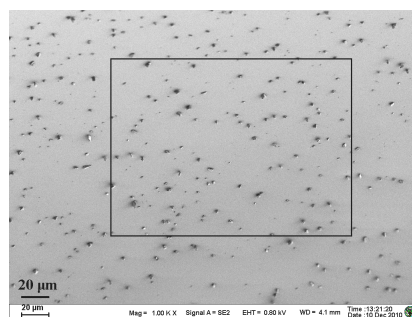


(a)

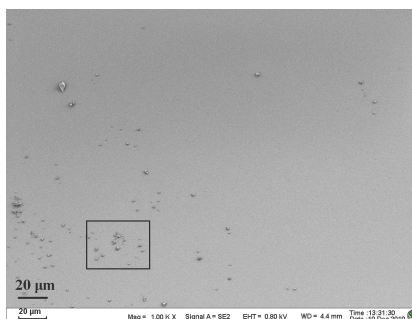


(b)

Figure E7 AFM of glass channel surfaces.(a) Inner wall surface; (b) Outer wall surface (Nano Probe Laboratory, NT-MDT Co., tapping mode).



(a)



(b)

Figure E8 SEM of inner wall surfaces of glass cavities. (a) the inner wall surface of the 'mother cavity' (Position 'A'); (b) the inner wall surface of the 'daughter channel' (Position 'B'). The black squares represent the EDS sampling area.