

＊課題番号 : F-12-NM-0072  
 ＊支援課題名 (日本語) : 三次元実装に向けた放熱流路評価  
 ＊Program Title (in English) : Investigation of Microchannels for Liquid Cooling of 3D Systems  
 ＊利用者名 (日本語) : メラメド サムソン  
 ＊Username (in English) : Samson Melamed  
 ＊所属名 (日本語) : 産業技術総合研究所  
 ＊Affiliation (in English) : National Institute of Advanced Industrial Science and Technology

＊概要 (Summary) :

3D Systems are a new technology that enable the stacking of integrated circuits into a combined system at the chip or wafer level. The resulting system has a higher heat density than traditional 2D systems. New methods for removing heat from these systems are necessary for them to be practical. This methods for integrating microchannels with liquid-cooling are being developed. Unlike prior research, this work is focused on developing methods that can be freely inserted, so that electrical connections are still possible through the layers with the microchannels. In particular this work is examining the applicability of using a new material, ShinEtsu SiNR in the fabrication of microchannel structures.

＊実験 (Experiments) :

【主に利用した装置】

レーザー露光装置  
 シリコン深堀エッチング装置  
 走査電子顕微鏡

【実験内容】

A Si wafer was first patterned using the laser exposure equipment at NIMS. The Bosch Process equipment at NIMS was then used to create 100-micron deep microchannels in the Si wafer. The new material, ShinEtsu SiNR was then laminated onto the wafers at AIST. The SiNR was then patterned using the laser exposure equipment at NIMS. Next a glass wafer was bonded to the stack using a thermal-compression machine at AIST.

＊結果と考察 (Results and Discussion) :

A pictorial version of the cross-section is shown below in Figure 1. A SEM micrograph of the cross-section is shown in Figure 2.

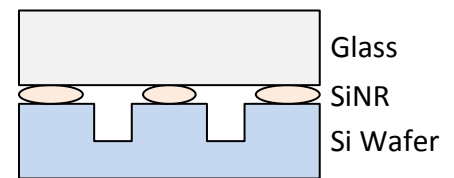


Figure 1: Si wafer with microchannels is bonded to a glass wafer using ShinEtsu SiNR in order to seal the microchannels.

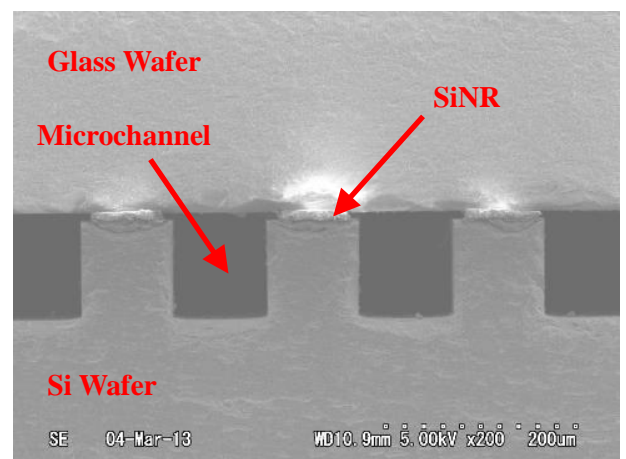


Figure 2: Cross-section of fabricated test-chip. Top is a glass wafer, middle is SiNR and bottom is a Si wafer with microchannels

The experiments to date have shown that SiNR can be properly patterned using laser exposure equipment. SiNR continues to look like a promising material for sealing microchannels.

＊その他・特記事項 (Others) :

Current plans are to continue this research at AIST and NIMS in the following year. The next step is to place the completed chip into a case to test the ability to flow water and other coolants through the microchannels.