

# Measuring interfacial fracture toughness of Si wafer/glass interface by blade test

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## Abstract

It is needed the packaging of micro sensor and micro machine for increasing the reliability of them and protecting them from surroundings. In optical micro sensor and micro machine using light, glass which light passes through is used to package the devices. Especially micro sensors should be hermetically sealed to protect the device and to decrease the influence of environments. The techniques of bonding Si wafer and glass are anodic bonding, eutectic bonding, fusion bonding, polymer bonding and low temperature glass bonding, etc. Among them, anodic bonding is used because of hermetic sealing.

In this study, the interfacial toughness of the interface between (100) Si wafer and Pyrex glass 7740, whose thermal expansion ratio is about the same as Si wafer's, bonded by anodic bonding method was measured. Si wafer's thickness is 400 $\mu\text{m}$  and glass's thickness is 500 $\mu\text{m}$ . The specimens were bonded on different temperatures of 450, 500 and 550 $^{\circ}\text{C}$  and on different voltages of 400 and 450V. In the process bonding pressure was 10torr. Al blade (about 10 $\mu\text{m}$  thick) was put in between Si wafer and glass in the bonding process to make initial crack. After the bonding process the crack was increased. The specimen was pictured over the glass to get the crack length and from it the interfacial toughness between Si wafer and Pyrex glass could be obtained. The result revealed that the interfacial toughness was changed by bonding temperature and bonding voltage, and that the interfacial toughness increased when the bonding temperature was increased.

Key words: anodic bonding, interfacial toughness, crack, Al blade, bonding temperature