

Visualization of atomic rearrangement behavior in bonded samples by heating in-situ TEM

ADB^{※1}(Atomic Diffusion Bonding) is used to improve the performance of various devices as a low temperature bonding technology for heterogeneous and homogenous wafers. This paper introduces an example of in-situ TEM observation of an ADB sample using an Au thin film and capturing the atomic rearrangement behavior of the Au bonding film during the heat treatment process.

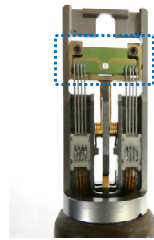
※1 T. Shimatsu and M. Uomoto : *J. Vac. Sci. Technol.*, B, **28** (2010) 706.

1. In-situ heating TEM

TEM observation under controlled thermal condition (Temp. : 23~1300°C)

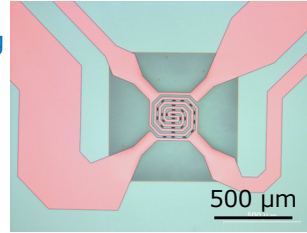
Visualization of thermal behavior at nm level

In-situ holder tip

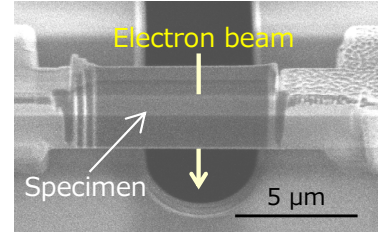


Heating chip

Heating chip (center)

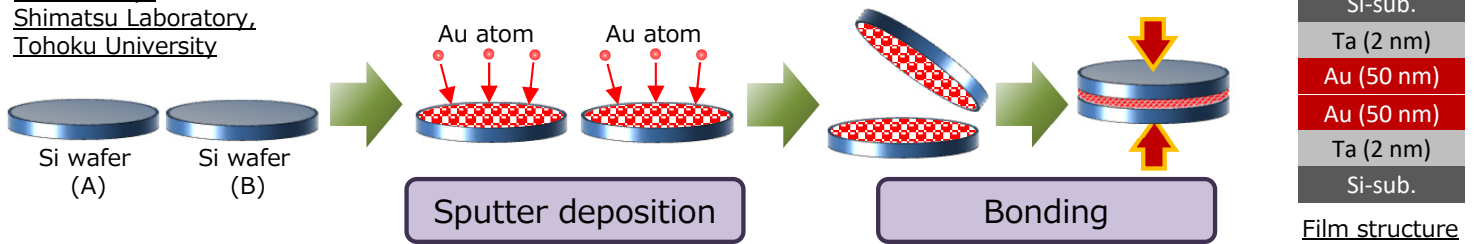


TEM specimen on chip



2. ADB sample preparation flow

Provided by:
Shimatsu Laboratory,
Tohoku University

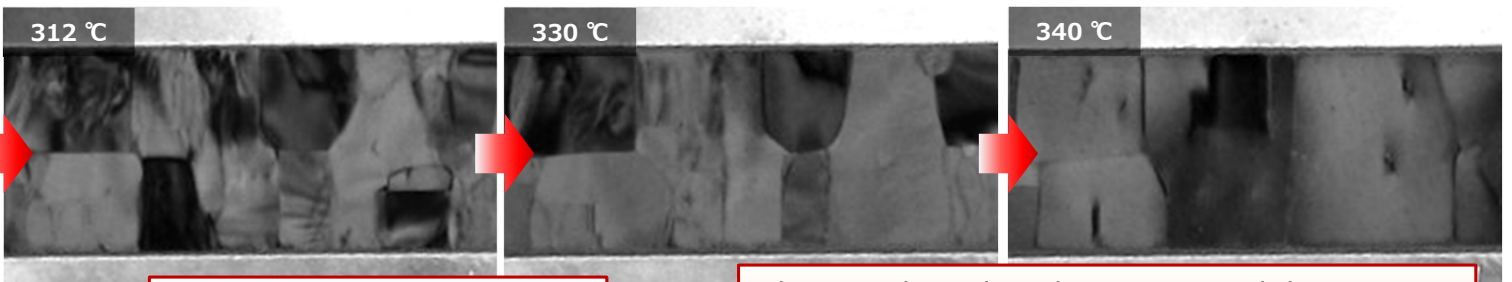


3. Heating in-situ TEM observation of Au-bonded sample



Heating condition : rate 1 °C/1 s
(Range : 23 °C-340 °C)

Atomic rearrangement progresses and Au crystal grain homogenization (structural relaxation) begins



Au crystal grains grow

The grain boundary disappears, and the upper and lower Au crystal grains are integrated

We use precise sampling technique and high-end observation technique to provide information on the cross-sectional structure of bonded samples.