

# Redistribution Layers on Glass Wafers

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*Research Group Website: Website: <https://www.mosaicmicro.com/>*

*Primary CNF Tools Used: ABM Mask Aligner, AJA Sputter System(s), Bruker DektakXT Profilometer, CHA Mark 50 E-beam Evaporator, Class 1 Photolithography Spinners, Class 2 Photolithography Spinners, GCA AS200 Stepper, Hamatech Wafer Processor(s), Heidelberg MLA 150 Maskless Aligner, Oxford 82 RIE, Oxford PECVD, PT 720-740 RIE, YES Asher*

## Abstract:

Glass substrates have excellent electrical and mechanical properties which have led to an increasing interest for their use in advanced microelectronic and photonic packaging applications. Glass substrates offer a very low loss tangent at GHz frequencies, while being moisture insensitive and dimensionally stable. This work outlines a novel approach for fabrication of interposers using thin glass (200 micron and below), normally difficult to handle in standard processes. The process yields void-free, hermetic, copper-filled precision through glass vias (TGVs), along with redistribution layer (RDL) fabrication with up to three metal redistribution layers per side. Furthermore, Mosaic Microsystems is developing various methods to integrate photonic waveguides with thin glass interposers to match high-speed electronics packaging with high-speed photonic communication.

## Summary of Research:

Due to Mosaic's patented Viafirm® bonding technology it is possible to process 100 mm, 150 mm, and 200 mm thin glass wafers with the conventional silicon processing equipment at the CNF. RDL fabrication utilizes the photoresist spinners and the ABM Mask Aligner for contact alignment or the GCA AS200 Stepper for features that require near micron resolution. Electron-beam evaporation of various metal layers has been performed using the CHA Mark 50 E-beam Evaporator.

In addition, our team uses the Hamatech HMx900s auto wafer developers to develop double layer liftoff resist structures applied at CNF. Analysis tools at CNF such as the Filmetrics F50 and Keyence microscope aid in resist and final pattern analysis.

## Conclusions and Future Steps:

We have successfully fabricated multi-layer RDL thin glass interposers. Our more recent work has focused on the fabrication of highly precise thin film resistors as well as microfluidic channels incorporated into the thin glass interposer. For the future, we will continue to improve upon our processes at CNF to deliver upon our customer's needs. We will also continue to develop methods of incorporating photonic waveguides with the thin glass interposers, of which key elements will occur at CNF.

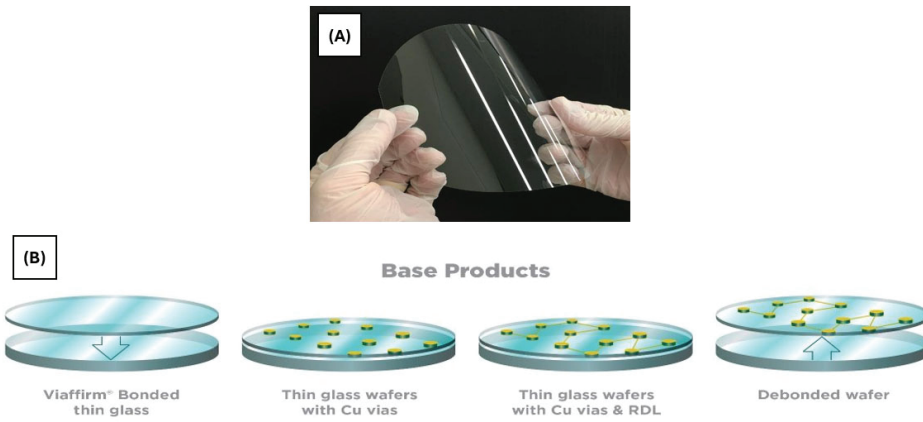


Figure 1: (A) Demonstration of the flexibility of thin glass. (B) Schematic outlining Mosaic's robust Viafirm® bonding process.

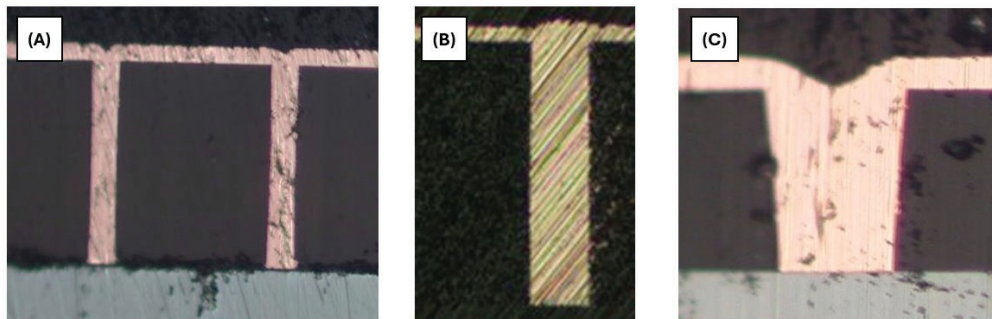


Figure 2: Cross-sections of fully filled copper vias with varying shapes and diameters. (A) 15  $\mu\text{m}$  columnar via, (B) 25  $\mu\text{m}$  columnar via, and (C) 35  $\mu\text{m}$  tapered via.

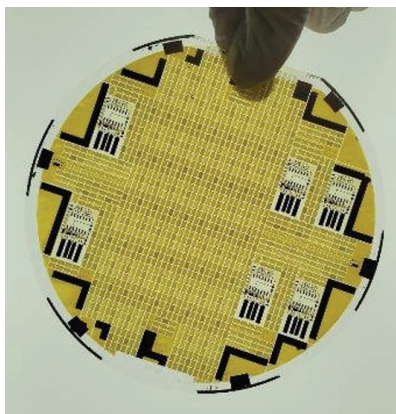


Figure 3: Example of a fully fabricated thin glass interposer with through glass vias and multiple redistribution layers.

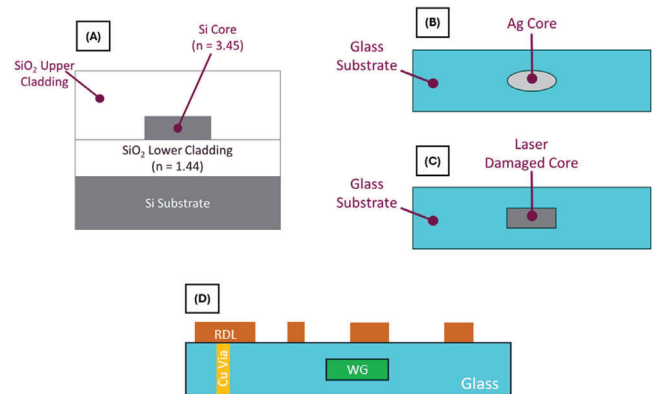


Figure 4: Schematic of various photonic waveguides. (A) Traditional silicon waveguide, (B) Ion-exchange waveguide, (C) Ultrafast laser inscription waveguide, and (D) Integration of electrical and optical communication.

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