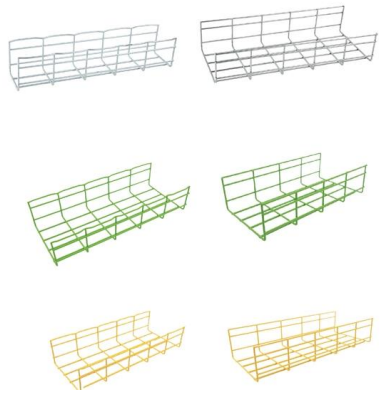
FRINDEL OPTICS

# Optoelectronic Fusion Bonding Technology


## Overview

Fusion or direct wafer bonding enables permanent connection via dielectric layers on each wafer surface used for engineered substrate or layer transfer such as backside illuminated CMOS image sensors. EVG's HI Competence Center is designed to help enable new products and applications driven by advances in system integration and packaging. Hybrid bonding extends fusion bonding with embedded metal pads in the bond interface, allowing for face-to-face connection of wafers. Focusing on photonic integrated circuits (PICs), which are based on SOI fabrication infrastructure, heterogeneous integration of III-V materials, such as indium phosphide (InP), enables high performance devices at low cost and high volumes. Fusion bonding plays a pivotal role in enabling CFET and BSPDN structures in logic devices, as well as advanced 3D memory structures.

# Optoelectronic Fusion Bonding Technology



## Wafer Bonding

Wafer bonding based on metallic bonding layers includes a wide range of technologies, such as TC bonding, solid-state diffusion bonding, solder bonding, eutectic bonding, and solid-liquid diffusion

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## Progress in wafer bonding technology towards MEMS, high-power

Based on the aforementioned background in different fields, we will introduce the progress and potential applications of wafer bonding technology in MEMS, high-power electronics, optoelectronics, and

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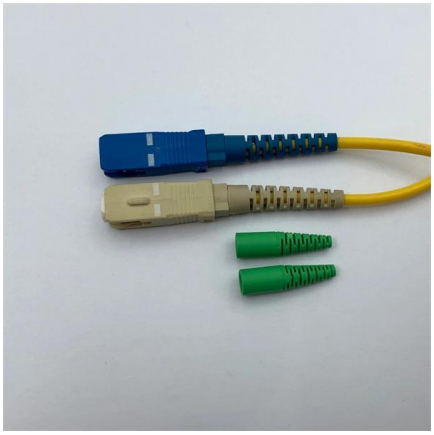

## Bonding Technologies for the Next Generation Integration Schemes

OutlineSt. Florian am Inn, AustriaProcess Development Process TransferEVG Heterogeneous Integration Competence CenterTMIntegration Schemes are Driven by Global MegatrendsWafer to Wafer Chip to Wafer Integration? Fusion bonding:? Plasma Activated Fusion Bonding:? Hybrid BondingProcess Flow I Fusion BondingFusion Bonding I MechanismFusion bondingCu dishingHybrid Bonding I Physical Mechanisms & Process Flow3D NAND Flash , Hybrid Bonding of Logic Circuitry to Memory CellAdvantages:Process CapabilitiesHigh Performance DeviceCollective Die Carrier , Process FlowDie placement accuracyCompatible Compatible with with multiple multiple bonding bonding technologies technologiesSAM/TEM analyses of transferred Die - Hybrid Bonding

EVG's Vision & Mission in Markets Driven by Global MegatrendsMission Critical ApplicationsIntroduction EVG at a Glance Recent Developments Product Portfolio & Competence Bonding Technology for the Next Generation Integration Schemes Introduction Bonding Requirements to meet trends Fusion & Hybrid Bonding ComBond® Wafer level vs. Die to Wafer integration Overview Process Results Summary & OutlookSee more on ewh.ieee Missing: OptoelectronicMust include: OptoelectronicEV Group

## Hybrid and Fusion Bonding - EV Group

Fusion or direct wafer bonding enables permanent connection via dielectric layers on each wafer surface used for engineered substrate or layer transfer such as

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**Micromachines , Special Issue : Optoelectronic Fusion**

Accordingly, this Special Issue aims to present research papers, communications, and review articles focusing on heterogeneous multi-dimensional fusion

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**Bonding Technologies for the Next Generation Integration Schemes**

Wafer Bonding Process Fusion / Hybrid Bonding Definitions, Principle Fusion bonding: Wafer bonding process based on the adhesion of two flat and smooth surfaces placed in contact occurred due to

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**Review of Low-Temperature Bonding Technologies and**

Wafer bonding for silicon-on-insulator technologies Wafer fusion: A novel technique for optoelectronic device fabrication and monolithic integration Bonding by atomic

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**Wafer Bonding: Applications and Technology , Request**

Such wafer bonding technology is a mature process, which is widely applicable for SOI wafer fabrication, MEMS technology, and optoelectronic device

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**Heterogeneous integration based on low-temperature**

In this paper, low-temperature direct bonding and intermediate layer bonding techniques are focused, and their state-of-the-art applications in

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**III-V/Si hybrid photonic devices by direct fusion bonding**

As a demonstration of our GaAs/Si direct bonding technique applied to optoelectronic devices, we have fabricated semiconductor lasers using self-assembled InAs quantum dots embedded in GaAs (InAs

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**Heterogeneous Wafer Bonding Technology and Thin**

Wafer bonding technology is one of the most effective methods for high-quality thin-film transfer onto different substrates combined with ion

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**High-Throughput Multiple Dies-to-Wafer Bonding**

In this paper, we propose and demonstrate a high-throughput multiple dies-to-wafer (D2W) bonding technology, which is then applied for the

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**1 Direct Bonding, Fusion Bonding, Anodic Bonding, Wafer Bonding: A**

Before World War II, direct bonding was mainly applied in classical optical in struments (e.g. interferometers); after World War II bonded semiconductor-wafer technology became a general

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**Wafer Bonding: Applications and Technology**

From the reviews: "Wafer bonding, also known as direct wafer bonding or wafer fusion, has developed from an almost obscure niche technology in the 1980s .

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**Femtosecond laser welding for robust and low loss**

Therefore, an epoxy-free bonding method using femtosecond laser welding borosilicate glass 3.3 and optical fibers is proposed and demonstrated.

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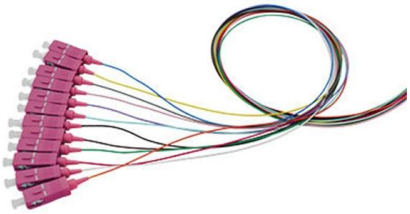

**III-V/Si hybrid photonic devices by direct fusion bonding**

Here we present a GaAs/Si direct fusion bonding technique to provide highly conductive and transparent heterojunctions by heterointerfacial band engineering in relation to doping

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**Wafer Bonding and Layer Splitting for Microsystems****

Therefore, not only materials combinations (integrated materials) are required for optimal device performance of each type but also process technologies for 3D device fabrication are essential.

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**Wafer bonding technology and its applications in optoelectronic**

The direct wafer bonding process has found broad applications in many critical areas including both commercial and state-of-the-art photonic devices and more recently, formation of semiconductor

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**Wafer Bonding Technologies for Microelectromechanical**

Wafer bonding is the process to permanently connect two or more wafers for three-dimensional (3D) integration in microelectromechanical systems

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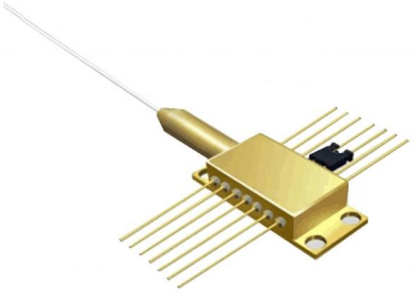

**Realizing Photonics-Electronics-Convergence technology! List of**

As Photonics-Electronics-Convergence technology accelerates, optical cables are now being used inside conventional devices such as optical switches. Miniature relay connectors are

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**Advanced bonding techniques for photonic integrated circuits**

Fusion wafer bonding has several advantages compared to other bonding techniques, which makes it particularly suitable for PICs. Pre-bonding happens at room temperature and therefore there is no

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**Progress in wafer bonding technology towards MEMS,**

Based on the aforementioned background in different fields, we will introduce the progress and potential applications of wafer bonding technology in

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**Joining technologies in optical and micro assembly**

In addition to the analytical and FEM-based simulation and optimization of joints, Fraunhofer IOF also conducts fundamental research into bonding and laser beam soldering technologies and adapts

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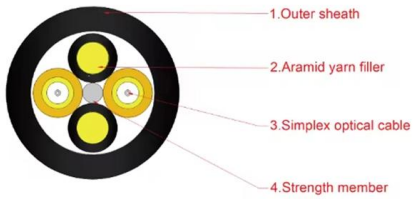


**The Future of Photonics: How AI is Accelerating Optoelectronic Fusion**

The rapid rise of generative AI is driving a technological revolution, with one of its most significant impacts being the acceleration of optoelectronic fusion technology. As data centers

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**Hybrid and Fusion Bonding to Enable Advanced Packaging**

Direct bonding is emerging as a critical technology for advanced 3D architectures. Fusion bonding plays a pivotal role in enabling CFET and BSPDN structures in logic devices, as well as advanced 3D

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**Wafer Fusion: Materials Issues And Device Results**

Abstract-- A large number of novel devices have been recently demonstrated using wafer fusion to integrate materials with different lattice constants. In many cases, devices created using this

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**Photoelectric fusion devices and silicon photonics**

Photoelectric fusion and silicon photonics technologies are key to building an all-photonics network. These technologies require high-precision

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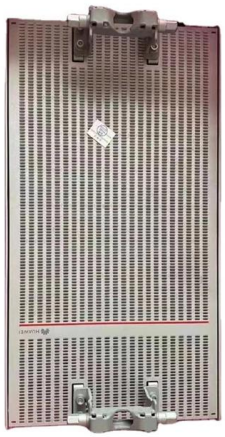


**Chapter 7 Evolution of Wafer Bonding Technology and**

This chapter firstly describes the traditional wafer-level MEMS packaging method, i.e., eutectic bonding. Interfacial studies for several commonly used sys-tems (i.e., Au-Sn, Au-In, In-Sn, and In-Ag) have

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**Wire Bonding in Optoelectronics , ASSEMBLY**

Optoelectronic packages present unique challenges for wire bonding technology. The hardest part about assembling optoelectronic packages-or at least the most publicized-is the process

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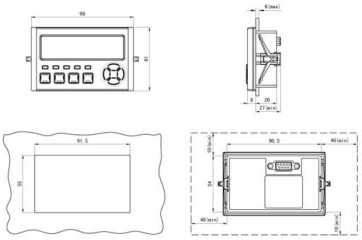

**Micromachines , Special Issue : Optoelectronic Fusion**

It will allow for the multi-functional integration of communications, sensing, and computing chips, as well as optoelectronic intelligent chips, promoting innovation

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For datasheets, pricing, or custom fiber access solutions, please visit: https://frindel.es