**Company Profile**

**Carrier Integration Inc.**

- **Silicon Carrier Manufacturer**

**Company Outline**

- **Name:** Carrier Integration Inc.
- **Establishment:** Dec. 10, 2010
- **Headquarters:** Tsukuba, Ibaraki Prefecture, Japan
- **Capital:** ¥18.5 million
- **Executives:** CEO: Yoshiyuki Amano (Four board members)
- **Main Business:** Production and distribution of Silicon Carrier (SC) for various semiconductor processing equipment
  - SC for exposure machines
  - SC for ion implantation
  - SC for etching & film deposition
- **Advantages for Customers:**
  - Productivity enhancement in manufacturing process, cost reduction, stable quality
- **Markets:** Japan, Europe, US, Taiwan, Korea
- **Offices:**
  - HQ: 814-1 Uenomuro Tsukuba-shi, Ibaraki, 305-0023 Japan
  - R&D Center: Chuou dai-1-1, 1-1-1 Umezono Tsukuba-shi, Ibaraki, 305-8568 Japan
  - Tokyo Office: 2-1 Ogawamachi Kanda Chiyoda-ku, Tokyo, 101-8475 Japan

**Business Structure**

Carrier Integration Inc. is a venture company supported by the National Institute of Advanced Industrial Science and Technology (AIST). The company was established on December 10, 2010, with the aim to provide a solution to the problems of new semiconductor wafers such as power transistors that are much highlighted -- “smaller diameters compared with those of silicon substrates, expensive, and easily cracked, chipped and warped.” (Certified as an “AIST technology transferred venture company” on July 15, 2011)

Through the provision of integrated wafer technology in the semiconductor industry, we will strive to gain customer satisfaction and trust and make contribution to the development of semiconductor industry and to the society.

**Technical Features**

- Brittle material processing by high-speed grinding
  - Silicon, ceramics, glass etc.
- High-precision processing on linear stage
  - Positional accuracy: < 10 μm
- Super-flat processing
  - Surface roughness: < 0.1 μm (Length: 30 mm)
  - Parallelism: 5 μm

**Main Product: Silicon Carrier**

- Silicon wafer for conveyance of small-diameter wafers:
  A product made of a SEMI-standard silicon wafer, etc. provided with a cavity and a holding mechanism, designed for holding, carrying and processing Φ1- to 6-inch or 20-mm square compound semiconductor wafers, etc.
- Quick delivery: Available in one week (after specification agreement)
- Customization: Grinding shape tailored to customer’s requirements
- Optimum for use in semiconductor research centers and various labs

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(1) What is Silicon Carrier?

- **A carrier made of a silicon wafer** provides a solution to the problems of new semiconductor wafers such as power transistors - "smaller diameters compared with those of silicon wafers, expensive, easily cracked, chipped and warped."
- Eliminates the need to modify semiconductor processing equipment
- **Quick delivery:** Available in one week (after specification agreed)
- **Price** (depending on spec. & qty.): Standard price of the product for Lithography Systems: from ¥250,000 and above

Silicon Carrier for exposure machines

![Diagram of Silicon Carrier](image)

Sample (SiC, etc.)
Fixing pin
Vacuum hole

(2) Total Solution for Small-diameter Wafer Conveyance

--- Carrier Method ---

**Silicon Carrier Manufacturer**

Silicon Carrier is a system to carry a small-diameter wafer (2 - 6 inches) by mounting it on an equipment-compliant silicon wafer (6 - 12 inches).

![Flowchart of Semiconductor Process & Silicon Carrier](image)

- **For cleaning**
- **For heat resistance**
- **For cleaning**
- **For C/D**
- **For steppers** (Cassette conveyance)
- **For resist removal**
- **For deposition**
- **For cleaning**
- **For C/D**
- **For etching**
- **For Development**
- **For cleaning**
- **For resist coating**
- **For Exposure**
- **For C/D**
- **For ion implantation**
- **For Activation**
- **For heat-resistant SC-B**
- **For ion implantation machines**
- **For etchers with electrostatic chuck**
(3) Main Technology for Our Carriers

--- Carrier Method ---

### Features of Technology

- **Grinding technology**: High-precision, high-flatness processing
  - Positional accuracy: < ±0.1 μm
  - Parallelism: < 5 μm
  - Surface roughness (Ra): < 0.1 μm (Length: 30 mm)
  - Freedom in processing materials (Silicon, quartz, ceramics, etc.)

- **Bonding technology**: heat resistance & low deformation
  - When only grinded, cracking and warpage may occur at high temperatures.
  - Our BD is heat resistant (1,000°C) and features low deformation.

- **Sample alignment & fixation technology**
  - High-precision θ angle control with accuracy adapted to exposure machine
  - Formation of suction hole (provided in exposure machines manufactured by Nikon and Canon)
  - Prevents displacement during transport of an exposure machine: Fixing pin
  - Metal fixtures, etc. with Teflon coating for ion implantation machines

- **Combining technology**
  - Allows attachment at 250°C and removal at 400°C.
    (New polyimide material used)
  - Adoption of combining equipment can establish an environment with excellent productivity.

**SC-G (Silicon Carrier Grinded)**

- In addition to technology outlined above, RIE/CVD of wafer surface, high-performance cleaning, etc. are available, as requested.

**SC-B (Silicon Carrier Bonded)**

**SC-C (Silicon Carrier Combined)**

(4) Application Range of Silicon Carrier

--- Carrier Method ---

<table>
<thead>
<tr>
<th>High temperature</th>
<th>Low temperature</th>
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<td>SC-B (Bonded carrier)</td>
<td>SC-C (Combined)</td>
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<tr>
<td>Price competitiveness</td>
<td>Price competitiveness</td>
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<tr>
<td>300°C</td>
<td>Universal carrier (Bonding method)</td>
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<tr>
<td>Small quantity</td>
<td>Large quantity</td>
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<tr>
<td>Improved flatness</td>
<td>Holding mechanism (Durability, productivity)</td>
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<tr>
<td>Lab application</td>
<td>For mass-production line</td>
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</tbody>
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**SC-G (Silicon Carrier Grinded)**

- Improved flatness
- Holding mechanism (Durability, productivity)

**SC-B (Silicon Carrier Bonded)**

**SC-C (Silicon Carrier Combined)**

- Heat resistance
- High purity
- (All-silicon structure)

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Features of Silicon Carrier for Different Uses

SC for lithography systems
- High-precision Θ angle (between crystal orientation of a sample and a notch/orientation flat on Silicon Carrier)
- Ensured flatness
- Holding mechanism for conveyance
- Freedom in sample sizes
  - SEMI, JEIDA wafers measuring 5-, 10-, 20-, 30-mm square, etc.
- Enables reuse of wafers broken during processing.

SC for Ion Implantation Machines
- Batch mounting of small chips and small-diameter wafers
- Prevents metal contamination by the use of Teflon fixtures
- Option: Socket structure against acceleration (2 G)
- Option: All-silicon structure by silicon bonding

SC for High-temperature Annealing
- Reduced stress strain at high temperatures
- Improved durability by silicon surface processing

SC for CVD
- High-purity material selected: Holding mechanism with Teflon cover
- High-purity cleaning

Customized Processing
- Processing of non-silicon materials also available, as requested.
- Processing of complicated structures also possible.
- Processable materials:
  - Metals, glass, minerals (quarts, granite, etc.),
  - ceramics, semiconductor wafers (silicon, SiC, GaAs, etc.)