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Document Title	Flip-chip-Diebonder
Description	Scope of a flip-chip-diebonder
Division/Organization	GSI Detector Laboratory
Field of Application	Project "FAIR Accelerator and Experiments"

Document History

Version	Created, date	Reason for modification
V001		Initial version

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1. Purpose and Classification of the Document

The purchase order 43096 is for a flip-chip bonder, which is necessary for the commissioning of the FAIR detectors at the FAIR Facility. A flip-chip bonder enables the placement of a CMOS sensor chip onto a suitable substrate with micrometer precision. An important example here is the Micro Vertex Detector (MVD) at FAIR CBM. For this system, approximately 1000 MIMOSIS 2.0 pixel chips—each with a pixel matrix featuring a 40 µm pitch—must be carefully removed from a cut wafer and placed on detector stations. This process involves placing and fixing numerous sensor chips onto the surface like tiles, while adhering to the pixel grid. The sensor chips are then electrically bonded to establish contact. This requires a special tool: a flip-chip diebonder.

2. Abbreviations, Terms and Definitions

For the purposes of this document, a “component” refers to an object that is applied to and placed on a substrate.

3. Scope of the Technical System

3.1. System Overview

The scope of the request for proposals covers an R&D Flip-chip Die bonder, a micro-assembly system with high placement accuracy and additional modules that enable various bonding processes, the precise application of adhesive and the picking of sensors and chips from wafers.

3.2. Scope of Delivery

The Flip-chip Die bonder should include the following process modules:

- Precision die bonding (face up)
- Flip chip bonding (face down)
- adapted system work table
- chip and substrate heating with process gas enclosure
- software-controlled bonding force module
- ultrasonic bonding module
- in-situ-monitoring with video camera
- form generator for creating reference elements for face up alignment
- tool tip changing module
- three different tool tips
- tool tip support including heater
- dispenser module for paste and liquids
- UV-curing module
- die-eject module

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3.3. Spare Parts and service

- Spare parts and service available for at least ten years.
- Service response time within 48 h.

4. System Specification

4.1. Technical Requirements for System Components

Item	Minimum requirements	Performance feature (detailing the minimum requirements)
Motorized micro-assembly system with high placement accuracy that can be tested and adjusted	Accuracy 3 μ m or better	3 x σ tolerance range for reproducible placement and bonding; more than 30 verifiable placements in a row at SAT
system work table	Fitting to die bonder	
Working area (X, Y)	350 mm x 150 mm	
Flexibility	supporting a multitude of bonding technologies and in particular retrofitability of formic acid module	Retrofittable for: - Thermocompression - Thermosonic / Ultrasonic - Soldering (AuSn, C4, Indium) - Formic Acid Module - Adhesive technologies Curing (UV, thermal) - Mechanical assembly
Component size	0,05 mm x 0,05 mm bis 100 mm x 100 mm	
Bonding force module up to 500 N	Up to 500 N	Tolerance 0,1N for forces up to 10 N, above that 1% of the rated value
Ultrasonic module	Up to 40 W	
Fine adjustment using micrometer screws for the X, Y, and Z and Theta axes (perpendicular to the bonding surface) and microscope assistance		
Table rotation	+/- 2° or more	
Precision alignment of large chips possible	For chips larger than standard field of view	Shifting at least 80 mm

In-situ-Process Monitoring using a video camera		
Form-generator	Ability to create graphic elements as passmarkers in the operating software for Face up alignment	
Tool tip changing module	The ability to change the tool tip during the process, for example, to enable the assembly of multichip modules	
3 pieces replacable tools for different component sizes for heated processes	For chip sizes: 5mm x 5 mm 10 mm x 10 mm 17,3 mm x 31,2 mm	
Tooltip-support including heater		
component (Chip)-heating	Controlled heating of the chip via the tool using a predefined temperature profile up to 450°	
Substrate heating with process gas enclosure	50 mm x 50 mm, up to 450°C, also integrated into a process control system designed to achieve a reproducible temperature profile	
Process gas enclosure	100 mm x 100 mm	
Glue-Dispense-unit	Controlled, high-precision dispensing of defined volumes of paste and liquid	
UV-curing-Module	Option to cure UV adhesive while the chip is held in place	
Die-eject-module to pick chips from wafer	Also suitable for 8"-wafers, chip size from 500 µm x 500 µm up to 20 mm x 30 mm	
Installation, site acceptance test and on site training		

4.2. Functional Requirements

Micro-assembly system that allows the following processes:

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- precision die bonding (face up)
- flip chip die bonding (face down)
- face up alignment with passmarkers
- thermocompression bonding
- ultrasonic bonding
- adhesive bonding
- UV-curing
- in-situ-monitoring
- Chip-picking from wafer placed on frames
- Option to retrofit additional modules, especially formic acid module

- on site training
- on-site customer service available

4.3. System Environment and Constraints

- system will be used in the cleanroom.
- area load <1,5 t/m²

5. Quality Assurance, Tests and Acceptance

Site acceptance test including

- testing and operation of the machine, including all modules.
- the verification of parallelism and positioning accuracy with more than 30 verifiable placements in a row

6. Documentation

Detailed User Manual