Key Enabling Process Technologies for Advanced Semiconductors, MEMS and Nanomanufacturing

P. Lindner, T. Glinsner, V. Dragoi, J. Weixlberger, C. Schaefer

EV Group, DI Erich Thallner Straße 1, A-4780 Schärding

New technologies like wafer level packaging, MEMS and Nanosystems frequently adopt semiconductor manufacturing processes at an early stage. Specific novel process steps however often develop to become key enabling. The paper will focus on two examples of key enabling process steps: wafer bonding and nano imprint lithography.

Wafer bonding enabled first the economic manufacturing of MEMS devices. Technological reasons for the success of the process in the MEMS community are mainly threefold:

- A bonded wafer stack forms a sealed “first level package” and therefore protects fragile micro machined features from harsh environments occurring during dicing.
- Allows to encapsulate a controlled ambient (like vacuum) to control a device’s sensitivity and adjust the properties.
- Stress Isolation: The first level package created at wafer level isolates mechanical stress introduced by the final package (mold or mounting method to board).

In addition, advanced semiconductors found benefit in the bonding technology through:

- Optical and electrical interconnects (3D interconnects) can be formed at wafer level rather than chip level in order to increase the integration density or the functional density of a device.
- Creation of chip scale packages at wafer level.
- New starting materials for advanced semiconductor and MEMS devices (most prominent example is the SOI Wafer).
- The ability to handle thin and ultra thin wafers for advanced power devices and compound semiconductors.

Examples of devices that utilize above mentioned benefits will be given as well as an overview of wafer bonding methods.

Classical lithography in semiconductor mainstream IC production employs stepper technologies today. Challenges and costs of this technology are steeply increasing at structures below 130 nm. Nano imprinting is a new method for generating pattern in submicron range at reasonable cost. It therefore has the potential for a wide variety of applications in BioMEMS, Biofluidics, Microoptics and Nanotechnology.

The paper will give an overview on emerging Nano Imprint Lithography (NIL) technologies:

- Hot Embossing (HE) which uses increased temperature to imprint a hard stamp into a polymer.

- UV Imprinting (UV Molding) which utilizes UV irradiation to cure a polymer between stamp and substrate.
- Micro Contact Printing (µCP) which transfers a self assembled monolayer (SAM) from a stamp to a substrate surface.

Equipment and tool technology was developed in the past years to support these new emerging imprinting methods.

About EV Group

EV Group (EVG), founded in 1980, is headquartered in Schärding, Austria and has subsidiaries in Phoenix, Arizona, Cranston, Rhode Island and Yokohama, Japan as well as representatives around the world. EVG manufactures a full line of wafer bonders, mask and bond aligners, photoresist coating systems and cleaners for microelectromechanical systems (MEMS) and semiconductor market segments. EVG's systems are used worldwide in high-volume production environments as well as research and development facilities. For more information visit the EVG web site at www.EVGroup.com, e-mail p.lindner@evgroup.at, or call EVG directly at +43 7712 5311-0.