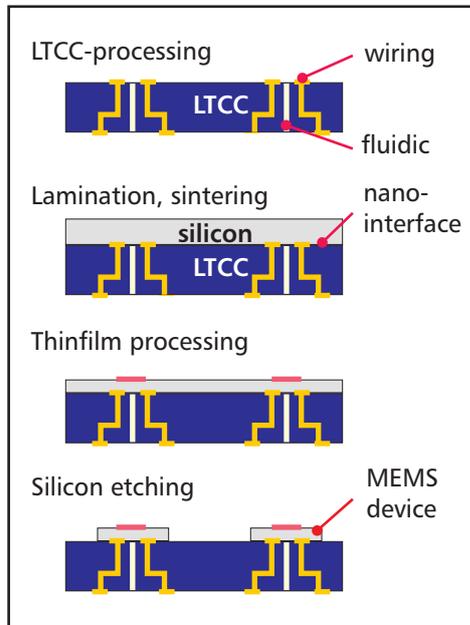


# A new method for wafer level integration of silicon components on LTCC

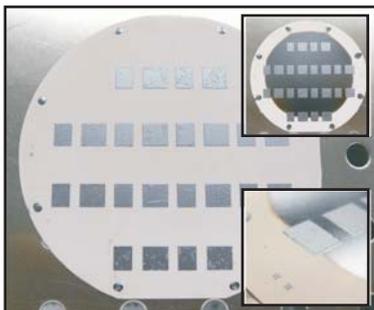
## Technology

- LTCC-tape with adapted thermal expansion to silicon
- Black Silicon (BSi) nanointerface combines form-fit with adhesive bond
- Pressure assisted sintering at 850°C (cofiring of LTCC and silicon)



## MEMS manufacturing

- Application of cofireable coatings before sintering
- Thin film processing for surface MEMS or etching after sintering



## Mechanical features

- Robust bond with high tensile strength
- LTCC acts as mechanical carrier for silicon components as well as an interface to printed circuit boards
- Use of silicon only if functionally necessary
- No additional materials with mismatched TCE

## Electrical features

- Cost-effective 3-d patterning by the use of standard LTCC processing
- Tailored LTCC interface with wiring and fluidic channels
- Contacting of silicon components by means of feed through wiring, direct contact or wire bonding
- Penetration of the metallized needles into the ceramic green body (via)
- Contact resistance between a gold via and a platinum layer of 3.3 Ohm

## Fluidic features

- Integration of nano elements into micro and fluid systems
- Average leak rates of  $2.8 \cdot 10^{-4}$  mbar l/s for helium = Liquid tight and a barrier for bacteria
- Best leak rates of  $1.9 \cdot 10^{-8}$  mbar l/s = Gas tight and a barrier for viruses

## Applications

- Heat spreader, chip cooling concepts
- BIO-MEMS and micro reactors
- Device and system packaging on wafer level, customized substrates
- Fully integrated system design
- Substitution of monolithic packages

