

## Members' Profiles

# KOA Corporation

### 1. Endeavors in Ceramic Packages

KOA Corporation has specialized in the manufacturing of electrical resistors for more than sixty years since its foundation and is a world leader in the types and production of electrical resistors through its worldwide sales network. Utilizing our base technologies in thin films, thick films, electroplating, and ceramics and innovative production activities, our objective is to contribute to production that respects humanity, reduces environmental impact, and enriches our lives.

Since 2001 we have been developing and manufacturing LTCC (Low Temperature Co-fired Ceramics) multilayer substrates as one of our newest endeavors, incorporating base technologies developed through the production of electrical resistors and various other electronic parts. The LTCC multilayer substrate is formed of a material that supports electronic devices, which continue to be made faster, smaller, lighter, and thinner, with more advanced functions. Moreover, KOA LTCC substrates not only have the excellent properties characteristic of ceramic substrates, but also have the capacity to respond flexibly to special shapes. There is also expectation that, in addition to electronic devices, these substrates will be developed as packages for use in MEMS technology.

### 2. LTCC Multilayer Substrates

LTCC is a ceramics technology in which glass material is added to alumina, enabling the alumina to be fired at a "low temperature" of 900 °C or less and can be used for simultaneously firing Ag as a conductor. In addition to their excellent heat resistance and humidity resistance, ceramic substrates also have excellent frequency characteristics (low loss) in high frequency circuits. Employing KOA's multilayering technique facilitates the formation of wiring patterns in surface layers and inner layers, making it possible to produce three-dimensional multilayer wiring at a high density. Since the LTCC substrates have a thermal expansion coefficient closer to silicon than do other organic substrates and ceramic substrates, less stress is produced during mounting, giving the LTCC substrates broad applications in high-frequency, multi-chip modules and circuit boards for semiconductor packages.

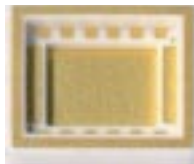


Photo 1 Cavity package



General Manager, LTCC Business Center  
Takuo Hayasi

### 3. Features of KOAs LTCC

Through KOA's own shrinkage control technology and multilayer technology, LTCC substrates can be produced with a high accuracy of  $\pm 0.05\%$  the design specifications. These technologies also make it possible to form thick films, thin films, and fine patterns using inkjet technology and to form resistive elements in surface layers and inner layers. By adding a green sheet layer with a cutout portion, cavities, hollow structures, and other complex shapes can be produced accurately. While LTCCs are widely used as substrates for small modules, the excellent properties possessed by LTCC materials suggest that applications for these substrates could be expanded through processes using the latest technologies.



Photo 2 One example of a special shape in which (square columns have been formed in a cavity)

### 4. Endeavors in MEMS Packages

While LTCC substrates have been primarily used in high frequency modules, development is currently underway on other applications for these substrates, such as in MEMS packages.

We are working to provide high-precision packages that draw out maximum performance in MEMS devices developed by our customers, such as ultrafine, high-level sensors and functional components. By further improving the LTCC technology for high-precision, high-density wiring and producing packages having a higher added value, KOA believes it can contribute to MEMS development and product commercialization. It is our hope that customers see the advantages of LTCC and incorporate these substrates in various applications.

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