A New Platform Concept for µ-SOFCs
Using Low Temperature Co-fired Ceramic Technology

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Introduction
- Micro-scale solid oxide fuel cell (µ-SOFCs) is a promising power generation technology for portable devices, however, its packaging system faces many challenges.
- Low temperature co-fired technology (LTCC) is a potential solution for µ-SOFC packaging due to its easy 3D structuration for fluidic channel integration, stable electrical connections, and outstanding thermal and chemical stability.
- The LTCC hotplate system (shown below) is designed as a high-integration packaging and test platform for µ-SOFCs.
- The current work aims to fabricate and assemble the LTCC hotplate system in order to reach high temperature (550°C).

The LTCC hotplate System
The system mainly consists of a LTCC hotplate, a ceramic base, a control circuit and a mechanical base. The system is operated by the LabView program with PID control through a LabJack UE9-Pro data acquisition card.

1. A LTCC hotplate soldered on the ceramic base
2. A LTCC hotplate with 2 Platinum meander heating tracks (btm.)
3. A control circuit for the R measurement of Pt PTC heating track
4. A mechanical base
5. An electrical connection to the power supply and LabJack UE9-pro data acquisition card
6. Thermal insulation (Superwool™ 607)

The LTCC hotplate processing
- Self-constrained Heraeus HeraLock HL2000 green tape used for better dimensional control.
- DuPont 951 (thicker, but large nominal ~13% XY shrinkage) used to achieve 1 mm thickness required for fluidic integration.
- HL2000 can largely constrain the shrinkage of ~3x thicker DuPont 951 (X: 1.36%, Y: 1.24%).

Samples layout (HL = HeraLock HL2000 ; DP = DuPont 951)

Temperature characterization
- The temperature of the LTCC hotplate system, measured by the attached Pt1000 thermistor, is currently limited to 180 °C by the power supply.

The LTCC hotplate system can melt Sn96 solder (melting point 221 °C) as a wetting ball given by the 12 V voltage supply.

Conclusion
- A LTCC hotplate system was fabricated for developing µ-SOFC applications.
- Combining different LTCC materials allows manufacture of thick (~1 mm) LTCC hotplates with low firing shrinkage.
- System temperature is currently limited to ~200°C due to combination of low supply voltage (12 V) and high heating track resistance (~150 Ω).
- Future work will focus on improving the heating capability of the LTCC hotplate system.

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