

Effects of thermal characteristics of brittle electrolyte ink on the crack generation in the coated electrolyte layer

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Abstract

In this study, we analyzed the effects of the thermal characteristics of a brittle electrolyte ink (yttrium stabilized zirconia, YSZ) on the crack generation in the coated electrolyte material. We considered the two factors affecting the crack generation: evaporation of the solvent entrapped in the sintered electrolyte layer and difference in the coefficients of thermal expansion (CTEs) between the electrolyte layer and the adjacent layer [1]. We analyzed the effect of the sintering temperature on the degree of crack. Moreover, we preceded the sintering with the evaporation of the solvent over the evaporation temperature of the solvent; the sintered layers were compared with those in which the solvent evaporation was not conducted. Using the results of the analyses, an alternative to decrease the crack in the brittle electrolyte layer during the sintering process was suggested.

Table 1 Property of yttrium stabilized zirconia

Property	Value
Electrolyte	Yttrium stabilized zirconia
Density [kg/m^3]	5,85
Young's modulus [MPa]	28.05
Coefficient of thermal expansion [$\text{m}/(\text{m}^\circ\text{C})$]	10.21×10^{-6}
Viscosity [cP]	30, 50
Weight percent [%]	34.74, 37.56

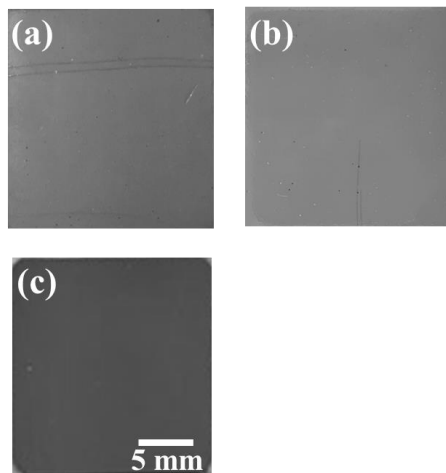


Fig. 1. YSZ layers cured at 1250°C (a), 1275°C (b) and 1300°C (c – d) (viscosity: 30 cP) [2]

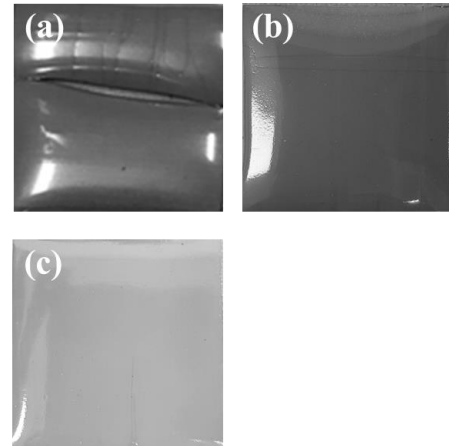


Fig. 2. Conventional YSZ layer (a) and the solvent evaporated YSZ layers at 100°C (b) and 120°C (c) (viscosity: 30 cP)

Acknowledgment

This research was supported by the Ministry of Trade, Industry & Energy(MOTIE), Korea Institute for Advancement of Technology(KIAT) through the Encouragement Program for The Industries of Economic Cooperation Region.(P0002215)

References

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