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Scaling up aqueous processing of A-site deficient strontium titanate for SOFC anode supports

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Abstract

All ceramic anode supported half cells of technically relevant scale were fabricated in this study, using a novel strontium titanate anode material. The use of this material would be highly advantageous in solid oxide fuel cells due to its redox tolerance and resistance to coking and sulphur poisoning. Successful fabrication was possible through aqueous tape casting of both anode support and electrolyte layers and subsequent lamination. Screen printing of electrolyte layers onto green anode tapes was also attempted but resulted in cracked electrolyte layers upon firing. Microstructural, electrical and mechanical properties of anode supports and half cells will be discussed. The use of two different commercial titanate powders with nominal identical, but in reality different stoichiometries, strongly affect electrical and mechanical properties. Careful consideration of such variations between powder suppliers, and batches of the same supplier, is critical for the successful implementation of ceramic anode supported solid oxide fuel cells.

Keywords: Solid oxide fuel cells
Alternative anodes
Perovskites
Tape casting
Co-firing

Introduction

Conventional state-of-the-art Ni cermet anodes for solid oxide fuel cells (SOFCs) perform well in hydrogen and high steam reformate fuels [1], but still suffer from a number of drawbacks. Their poor redox stability, tendency for coking in hydrocarbon fuels and low sulphur tolerance has led many researchers to look for alternative anode materials. One promising approach is to replace the cermet with an electronically conducting ceramic to provide both structural support and current collection, whereas electrocatalytic activity can be obtained through impregnation of precursors solutions of electrocatalytically active materials into the porous scaffold. A-site deficient strontium titanates show high n-type conductivity and therefore offer promise as the electronically conducting backbone. Previous work has