

Nanocomposites and nanomaterials

Creation of suspensions and obtaining of ceramic tapes for fuel cells by tape casting method

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Creation of ceramic tapes by the Tape Casting method for later use in the solid oxide fuel cell (SOFC) is an important task because of the high performance, low cost and environmentally friendly of this method. However, to obtain high-quality tapes some technical problems needs to be solved. The tapes must have different thickness and porosity with equable powder distribution by volume and low surface roughness. In this work, we consider the methods of preparation and analysis of suspensions which used to obtain the tapes for fuel cells. The effect of casting conditions on the basic properties of the tapes was studied. The tape defects were analyzed and methods of to avoid it was suggested.

The 8YSz and NiO powders were used as a solid phase of tapes. The polyvinyl butyral (PVB) were used as the binder, 1-n-butanol and isopropyl alcohol as solvents and dibutyl phthalate as a plasticizer. Was obtained a porous anode tapes with a thickness of 100 to 400 microns from a mixture of 8YSz and NiO powders, high-density electrolyte tapes with a thickness of from 50 to 150 microns based on 8YSz powders and tapes of contact layer with a thickness of about 70 microns based on NiO powders.

The anode layer except the electrode function must perform an additional function of a framework. For providing this function it must have a higher thickness to provide a needed mechanical strength. Obtaining of thick tapes is difficult because of formation of defects on the tape surface during drying. To eliminate such defects, the factors that are causing them to appear were determinate, suspension composition was specifically formulated and certain mode of tape drying was established. Using a rotational viscometer for rheological analysis of the suspension allowed to establish optimal conditions for tape casting according to their flow curves.

In addition to the successful creation of a fuel cell using a tape obtained by Tape Casting, a basic relationship between tape thickness and technological parameters such as doctor blade's height and speed of the vehicle were set. The influence of the viscosity of the suspension on the thickness of the obtained tapes was established. The causes of surface tape defects were clarified and special techniques to avoid it were used.