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Ceramic processing of tubular, multilayered oxygen transport membranes (Invited)

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Pure oxygen gas supplied by ceramic oxygen transport membranes (OTMs) can facilitate reduced CO_2 emissions through more efficient gasification or combustion processes and easier CO_2 capture and storage. For maximum oxygen flux and 100% selectivity, the active OTM layer should be thin and dense, and have a large and catalytically activated surface area. These requirements call for an asymmetric OTM design with a thin, dense OTM layer (~15 µm) sandwiched between two porous catalyst layers (~15 µm) and mechanically supported on a porous ceramic substrate (~1 mm). This talk pertains to our work at the Technical University of Denmark (DTU) related to processing such multilayered ceramic components with a tubular geometry, focusing on scalable process technologies. This includes thermoplastic extrusion to shape the porous, tubular support, deposition of thin dense and porous layers by dip coating, co-sintering of these layers, and infiltration of electrocatalysts. Material and processing considerations for two different combinations of materials in the multilayered components will be discussed, and performance of these components under laboratory testing and integrated in pilot-scale biomass gasifiers will be presented.