

# T05: Ceramics for novel energy conversion, storage and use

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## Invited lectures

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### **Mixed ionic-electronic conducting membranes: fundamentals and challenges**

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Mixed oxygen ionic-electronic conducting (MIEC) oxides hold promise for use as oxygen transport membranes to produce high-purity oxygen. Such membranes may further be integrated in ceramic membrane reactors for oxy-fuel combustion and syngas applications. In addition to reliability of operation under actual operating conditions, the challenge to researchers is to develop membrane materials showing fast oxygen diffusion and surface exchange kinetics. The present paper surveys theory and research on oxygen transport in the MIEC materials, with emphasis on defect chemistry and surface exchange kinetics; progress, problems and perspectives in the development of membrane materials; and identifies directions for future research.

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### **Design principles for perovskite photoferroics**

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Photovoltaics rely on the separation of photoinduced charge carriers, which normally requires careful engineering of electron and hole attracting electrodes or p-n junctions, as in conventional solar cells. However, ferroelectrics display a spontaneous polarisation that can induce spontaneous photocurrents, allowing for greater flexibility in photovoltaic device architectures and the potential to circumvent the Shockley-Queisser.<sup>1-3</sup> Unfortunately most known ferroelectrics are poor absorbers of sunlight and poor conductors due to their relatively large optical band gaps.

In this talk I will discuss one strategy to induce ferroelectricity in the halide hybrid perovskites, which have recently received heightened attention due to their promising pho-