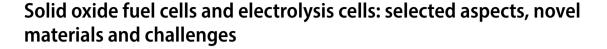
EDITORIAL



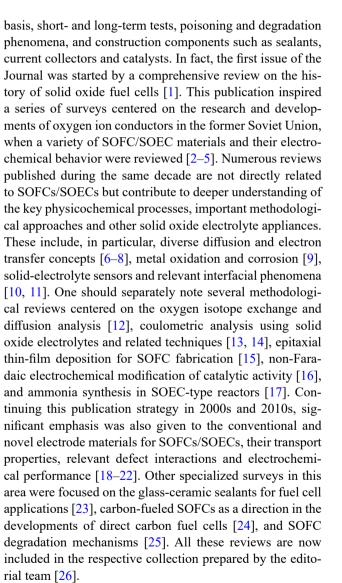
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Technologies using solid oxide fuel cells (SOFCs) and solid oxide electrolysis cells (SOECs) are already mature enough, which makes it possible to consider them as an important part of the future hydrogen production and hydrogenbased electric power generation. The advantages of SOFCs include a high energy-conversion efficiency, a possibility to recover exhaust heat, flexible modulability, environmental safety, and fuel flexibility including the prospects to directly operate on light hydrocarbons and biogas. The former advantages are also characteristic for SOECs used to produce high-purity hydrogen from steam. Important applications of SOFCs/SOECs combined with the chemical energy storage systems are related to balancing of the power-generation and consumption peaks, which is often necessary for solar, wind and nuclear power plants. The SOFC and SOEC technologies may also find a number of other environmentally friendly applications. For instance, SOECs can be used for CO₂ electrolysis, enabling carbon dioxide conversion into value-added chemicals and reducing emissions in the atmosphere. The SOFC-based power and heat cogenerators can be used for utilization of the calorific waste gases produced by industry and municipal solid waste landfills, again decreasing environmental threats.

This brief introduction explains a permanent attention and a high priority given by the editorial team of the Journal of Solid State Electrochemistry to most aspects of SOFCs/ SOECs developments, including interdisciplinary scientific and technological fields. Since its foundation in 1997, the Journal publishes a great number of reviews and research articles dealing with solid oxide electrolytes, SOFC/SOEC electrodes and electrochemical reaction mechanisms, modelling of the electrochemical cells and devices on their

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In connection with the collection of reviews, the present topical issue of the Journal contains a selection of experimental and computational works reflecting recent trends and challenges in the field of SOFC/SOEC developments. The





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focus was placed, first of all, on materials science-related aspects, including the studies of oxygen ion- and protonconducting solid oxide electrolytes, mixed ionic-electronic conductors, catalysts, and perovskite/like compounds promising for the use in electrode systems. The aspects regarding to the cell architectures, fabrication methods and operation regimes were addressed as well. Having presented a brief introduction to this collection of reviews and new topical issue, the editorial team trust that the readers may find the contents interesting and stimulating.

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References

- 1. Möbius H-H (1997) J Solid State Electrochem 1:2
- Kharton VV, Naumovich EN, Vecher AA (1999) J Solid State Electrochem 3:61
- Kharton VV, Yaremchenko AA, Naumovich EN (1999) J Solid State Electrochem 3:303
- Kharton VV, Yaremchenko AA, Naumovich EN, Marques FMB (2000) J Solid State Electrochem 4:243
- Kharton VV, Naumovich EN, Yaremchenko AA, Marques FMB (2001) J Solid State Electrochem 5:160. https://doi.org/10.1007/ s100080000141
- 6. Maser K (1999) J Solid State Electrochem 4:3
- Lee S-J, Pyun S-I, Shin H-C (2009) J Solid State Electrochem 13:829. https://doi.org/10.1007/s10008-008-0617-0
- Fletcher S (2010) J Solid State Electrochem 14:705. https://doi. org/10.1007/s10008-009-0994-z
- Schmuki P (2002) J Solid State Electrochem 6:145. https://doi. org/10.1007/s100080100219
- Pasierb P, Recas M (2009) J Solid State Electrochem 13:3. https:// doi.org/10.1007/s10008-008-0556-9

- Fergus JW (2011) J Solid State Electrochem 15:971. https://doi. org/10.1007/s10008-010-1046-4
- Kilner JA, Skinner SJ, Brongersma HH (2011) J Solid State Electrochem 15:861. https://doi.org/10.1007/s10008-010-1289-0
- Patrakeev MV, Leonidov IA, Kozhevnikov VL (2011) J Solid State Electrochem 15:931. https://doi.org/10.1007/s10008-010-1111-z
- Vashook V, Zosel J, Guth U (2012) J Solid State Electrochem 16:3401. https://doi.org/10.1007/s10008-012-1876-3
- Santiso J, Burriel M (2011) J Solid State Electrochem 15:985. https://doi.org/10.1007/s10008-010-1214-6
- Vayenas CG (2011) J Solid State Electrochem 15:1425. https:// doi.org/10.1007/s10008-011-1336-5
- Amar IA, Lan R, Petit CTG, Tao S (2011) J Solid State Electrochem 15:1845. https://doi.org/10.1007/s10008-011-1376-x
- Petrov AN, Cherepanov VA, Zuev AY (2006) J Solid State Electrochem 10:517. https://doi.org/10.1007/s10008-006-0124-0
- Tsipis EV, Kharton VV (2008) J Solid State Electrochem 12:1039. https://doi.org/10.1007/s10008-007-0468-0
- 20. Tsipis EV, Kharton VV (2008) J Solid State Electrochem 12:1367. https://doi.org/10.1007/s10008-008-0611-6
- 21. Sun C, Hui R, Roller J (2010) J Solid State Electrochem 14:1125. https://doi.org/10.1007/s10008-009-0932-0
- 22. Tsipis EV, Kharton VV (2011) J Solid State Electrochem 15:1007. https://doi.org/10.1007/s10008-011-1341-8
- Reddy AA, Tulyaganov DU, Kharton VV, Ferreira JMF (2015) J Solid State Electrochem 19:2899. https://doi.org/10.1007/ s10008-015-2925-5
- 24. Deleebeeck L, Hansen KK (2014) J Solid State Electrochem 18:861. https://doi.org/10.1007/s10008-013-2258-1
- Sreedhar I, Agarwal B, Goyal P, Agarwal A (2020) J Solid State Electrochem 24:1239. https://doi.org/10.1007/ s10008-020-04584-4
- Solid oxide fuel cells and electrolysis cells SOFCs/SOECs (2024) J Solid State Electrochem. https://link.springer.com/collections/bdcehjcfii. Assessed 21 Mar 2024

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