Development of new furnace technologies (H2, electric, blend) and constraints

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Abstract

Today's main challenge is freeing the world of fossil dependency and finding effective solutions for traditional processes. The glass industry uses a high-temperature process to transform raw materials into melt. In this process, the primary energy sources are oil and natural gas. Currently, all-electric and hybrid furnaces with large electric heating systems are slowly replacing traditional regeneratively-fired furnaces. Here, the higher heating efficiency of direct electric heating, compared to the combustion process, reduces the specific energy demand for glass production. However, today's energy mix with an average carbon footprint between 400 and 1000 gCO2e/kWh restrains the decarbonization potential of the glass sector. Therefore, the decarbonization of the energy sector, especially the availability of renewable energy, directly impacts the potential for decarbonization in the glass industry. In the coming years, the choice of melting technology will be heavily influenced by the local availability of renewable energy, green hydrogen, and other decarbonized fuels. This underscores the need for furnace designs that can adapt to local circumstances. In the long run, the glass industry will embrace and develop technologies that allow for high electric shares in the melting process, as electricity is projected to be the most cost-effective energy source. Computational fluid dynamics simulations will play a crucial role in these developments as they help to understand the impact of design changes and can give valuable insight into optimal process control.

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