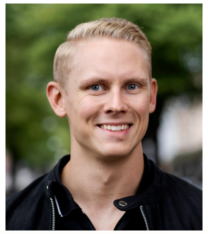
In an era defined by the pressing challenges of climate change and dwindling fossil fuel reserves, most of the world's total energy consumption is still provided by fossil fuel sources. Carbon dioxide emissions from fossil fuel combustion are the largest contributor to global warming, and the emissions grows continuously, despite the global economic slowdown. As societies grapple with the imperative to drastically reduce emissions, researchers, policymakers, and industries are increasingly turning their attention to negative emission technologies for heat and power generation.

Chemical looping combustion is a technology in which fuels can be thermally converted with subsequent carbon capture, enabling negative CO2 emissions when biomass is used as fuel source. Alkali metals are readily released during the biomass conversion process and may cause significant operational challenges. While their presence may have catalytic effects on fuel conversion, they are generally associated with detrimental problems, including agglomeration of fluidized bed particles, and fouling and corrosion of heat extraction equipment. As such, a comprehensive understanding of alkali metal behavior in chemical looping is essential for optimizing system performance and designing robust and sustainable processes.

This thesis provides knowledge about the interactions between alkali metals and fluidized bed materials used for chemical looping combustion. The work includes developing novel alkali monitoring methods and laboratory reactor systems to monitor the alkali dynamics between different alkali salt compounds and bed materials. The aim is to enable the development of more efficient and reliable biomass conversion technologies with the potential to outperform and eventually replace the fossil-based energy generation industry on which we currently rely.



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