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Performance analysis of an IT-SOFC/GT hybrid system using gasified biomass fuel under different operating modes

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This work elaborates the load performance and safe characteristic of an intermediate-temperature solid oxide fuel cell (IT-SOFC) and a gas turbine (GT) hybrid system using gasified biomass fuel under different operating modes. Three operating modes are adopted to investigate the off-design performance. And some malfunction restrictions of components (such as fuel cell thermal crack, compressor surge, reformer carbon deposition) are also considered for the effect of operating mode. Results show that the hybrid system has a high efficiency 60.78% at the design point using wood chip gas, which is an interesting reference for distributed power stations. The system output load changes almost from 46% to 120% when it is operating with Modes A and C, however, the compressor surge is occurred easily with Mode A. When with Mode B, the system has a rather wider load range than that of above two operation situations, but its performance variation is very complicated. The system performance will be affect by the too low turbine inlet temperature and carbon deposition phenomenon occurred in the reformer when in low load operation. The system can't operate safely because the turbine is damaged easily by the too high inlet temperature when in high load operation. The results further illustrate that, the designer or the user should pay attention to the matching relationship between too much flow rate and flow characteristics for turbine and compressor, when the high load output is required.

Biography

Xiaojing Lv is a Postdoctoral Researcher in School of Mechanical Engineering, Shanghai Jiao Tong University. Her main research direction is advanced power cycle system based on high temperature fuel cell and gas turbine, and the scientific utilization of low calorific value gas. She has authored more than 15 papers in both international and national journals.

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