Flashback in hydrogen flames for gas turbine application

By Prof. dr. ir. S.A. Klein, Process & Energy, Faculty 3mE, TU Delft

Abstract:

Flexibility is key to support future electricity generation. The growth in renewable solar and wind energy has emphasized the need for flexibility. Flexibility to reliably balance the load on the energy grid with the ability to rapidly adjust output while using cost effective fuels which also minimize carbon output. Gas turbines with a retrofit for hydrogen operation offers a low carbon solution to support the stability of the energy grid. However, hydrogen is a highly reactive fuel and presents challenges for industry standard dry low NOx combustors to switch between natural gas and hydrogen fuel blends while remaining stable and with NOx emissions always below stringent limits. Significant concerns regarding emission compliance, combustion dynamics and stability must be addressed prior to operation on these fuels.

TU Delft research focuses on the significantly increased flash back risk for hydrogen combustion, the main challenge for large scale reliable application of hydrogen in lean-premixed combustors. This presentation will discuss the latest insights in flashback phenomena in hydrogen flames also in comparison with natural gas flames. The classical flashback theory by Lewis and von Elbe will be challenged although the predicted flashback limits from (adaptions of) this theory appear to predict flashback limits quite well.

We will present both modelling/theoretical results and results from the experiments in the TU Delft laboratory.