

# Experimental Study of Induction Time with H<sub>2</sub> - CH<sub>4</sub> and H<sub>2</sub> - CO – Mixtures

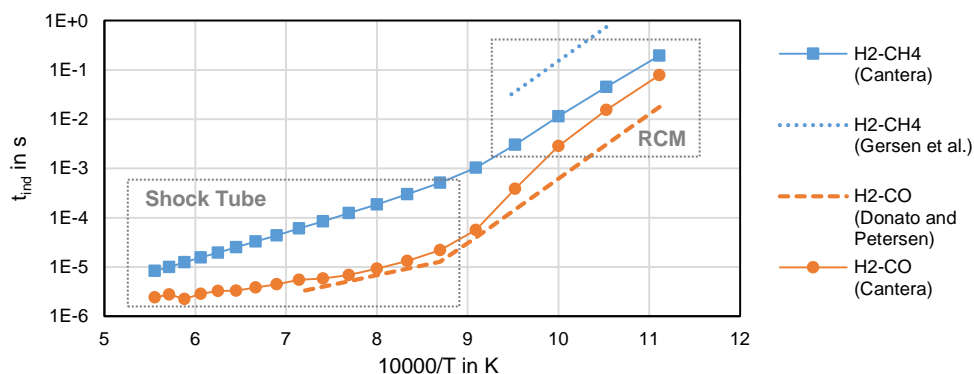
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Hydrogen, as a promising energy carrier, receives growing importance for the storage and distribution of renewable energies. For instance, mixtures of H<sub>2</sub> - CH<sub>4</sub> and H<sub>2</sub> - CO occur, when hydrogen is fed into the natural gas grid or as a result of the breakdown of biomass, respectively. Hence, they are of growing interest regarding safety related aspects, such as induction time. In view of the available studies linked to the above mixtures, a lack of experimental data emerges, especially for undiluted, stoichiometric mixtures with air at elevated pressures. The objective of the present study therefore, is to measure the induction time at pressures of up to 50 bar and of relatively low temperatures, using an already existing rapid compression machine (RCM) and a newly designed high pressure shock tube. Thereby, the RCM covers the low temperature domain (900...1100 K) with comparatively long induction times, whereas the shock tube is suitable for higher temperatures (1100...1800 K) in conjunction with short ignition delays (operational ranges shown in Fig. 1). Numerical studies on induction time using the Cantera code with different chemistry have been conducted to specify interesting parameter ranges. In addition to temperature and pressure, the mixture ratio of hydrogen to methane and carbon monoxide is also varied. Currently, the shock tube for pressures of up to 600 bar at a total length of ten meters is constructed at KIT. The intended measurements cover a temperature range of 900 to 1800 K, with pressures of 5 to 50 bar. Some results of the numerical study are shown in Figure 1.



**Fig. 1:** Comparison of numerically determined induction times and correlations given by Gersen et al. (1) for H<sub>2</sub>-CH<sub>4</sub> - mixtures and Donato and Petersen (2) for H<sub>2</sub>-CO – mixtures (applicable to all curves: mixture ratio = 50:50, pressure = 5 bar, equivalence ratio = 1)

## References

- (1) Gersen, S.; Anikin, N.B.; Mokhov, A.V.; Levinsky, H.B. *International Journal of Hydrogen Energy*. **2008**, 33, 1957-1964.
- (2) Donato, N.S.; Petersen, E.L. *International Journal of Hydrogen Energy*. **2008**, 33, 7565-7579.