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Risk-reduction for hydrogen installations by partial suppression of explosions

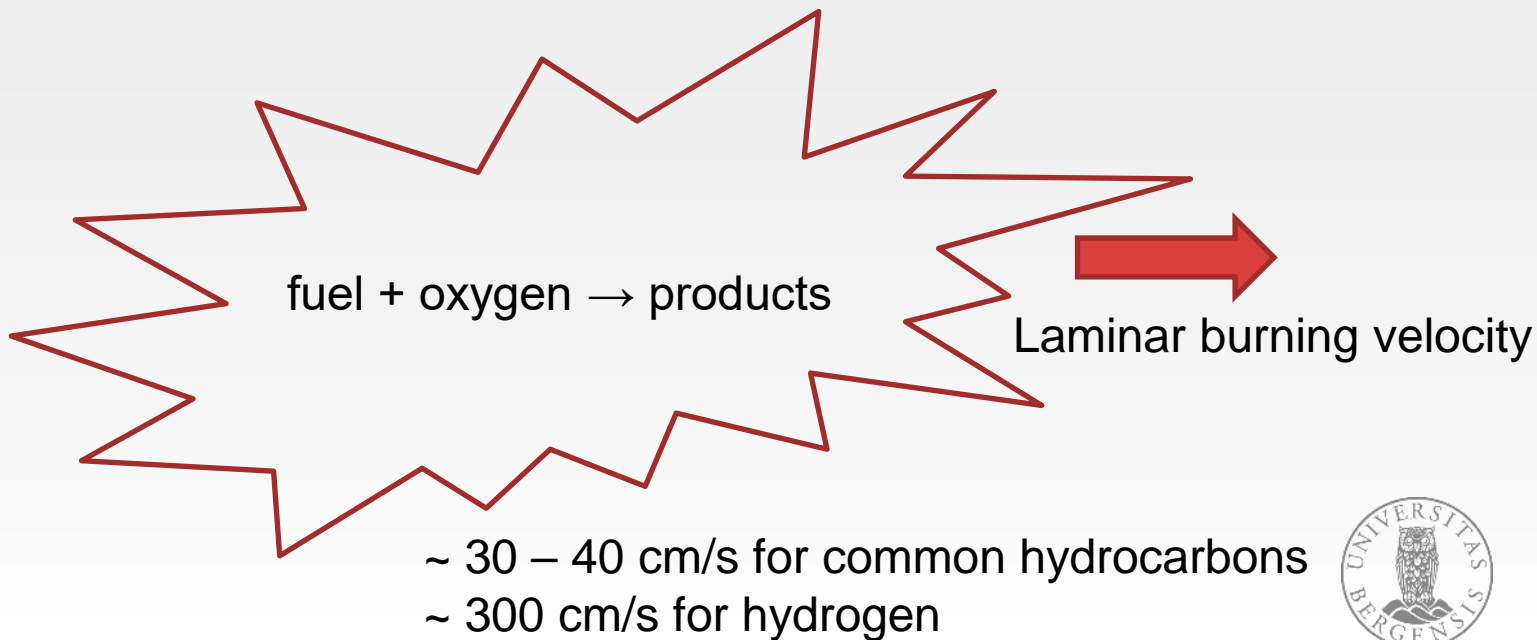
BEL lunch webinar 24.05.2022

Matthijs van Wingerden

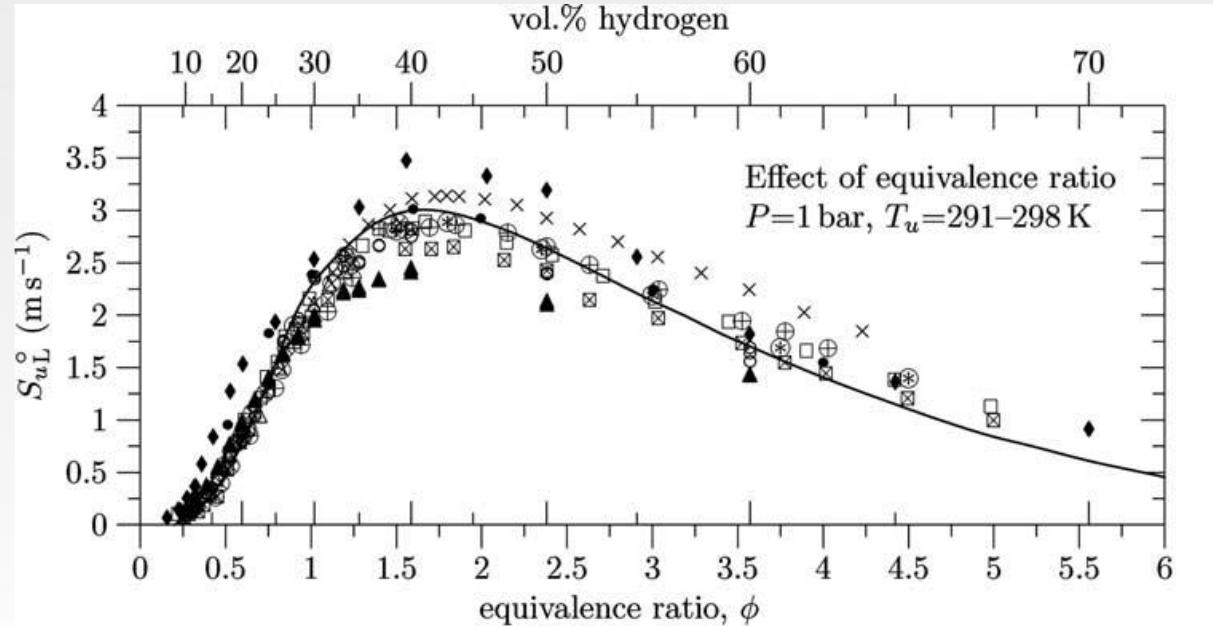
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Vapour cloud explosions



Vapour cloud explosions



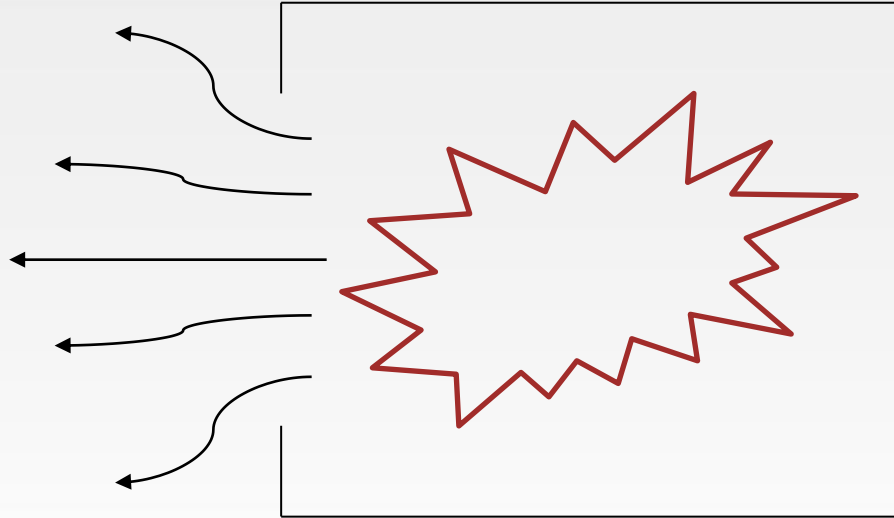
Dahoe 2005



Vapour cloud explosions



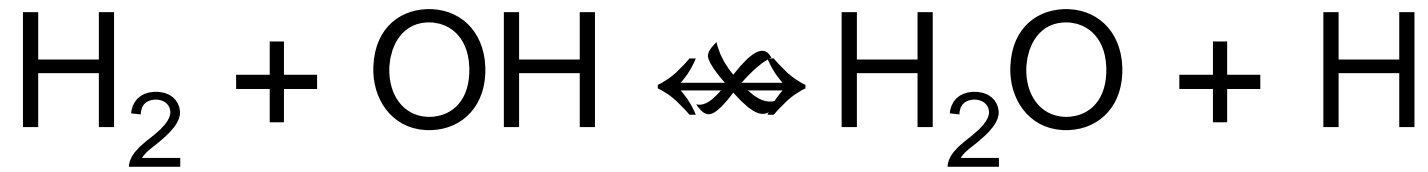
Vapour cloud explosions



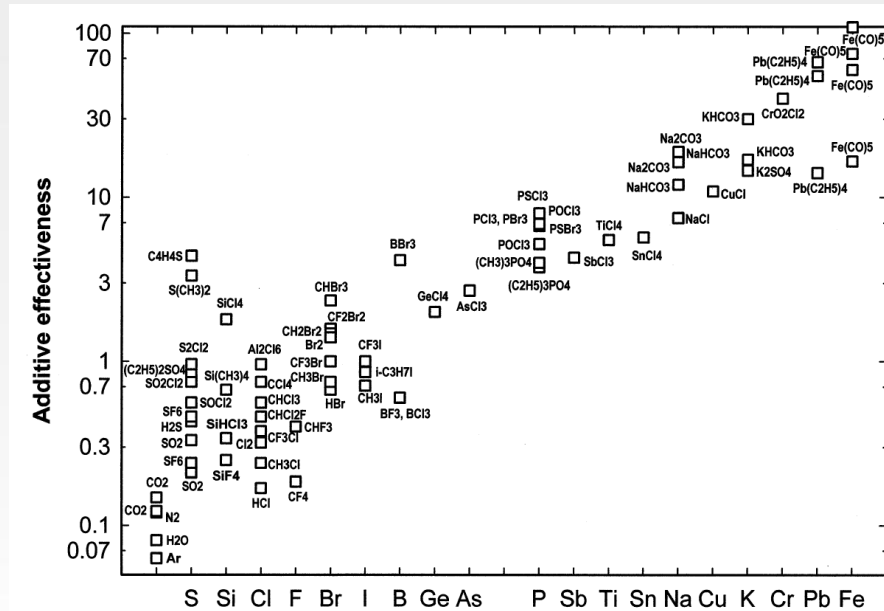
Reducing the reactivity

- Reduction by inerting (N_2 , CO_2)
- Reduction by cooling (H_2O)
- Reduction by chemical inhibition





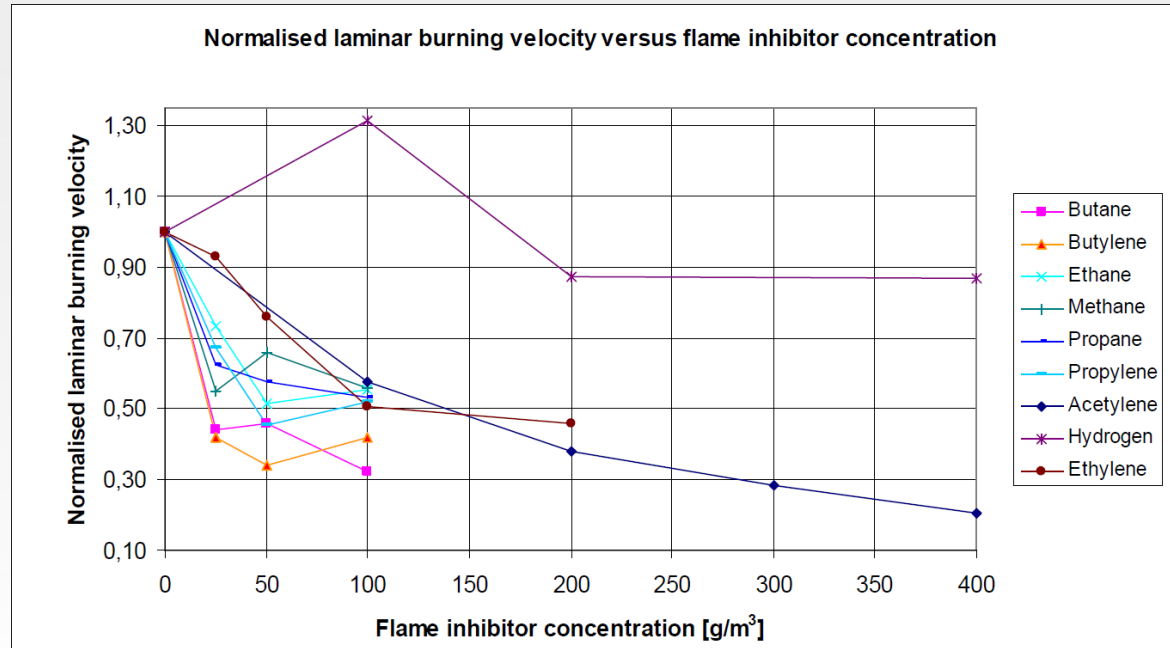
Inhibitors and hydrocarbons



(Babushock 2000)



Inhibitors and hydrogen



(van Wingerden 2011)



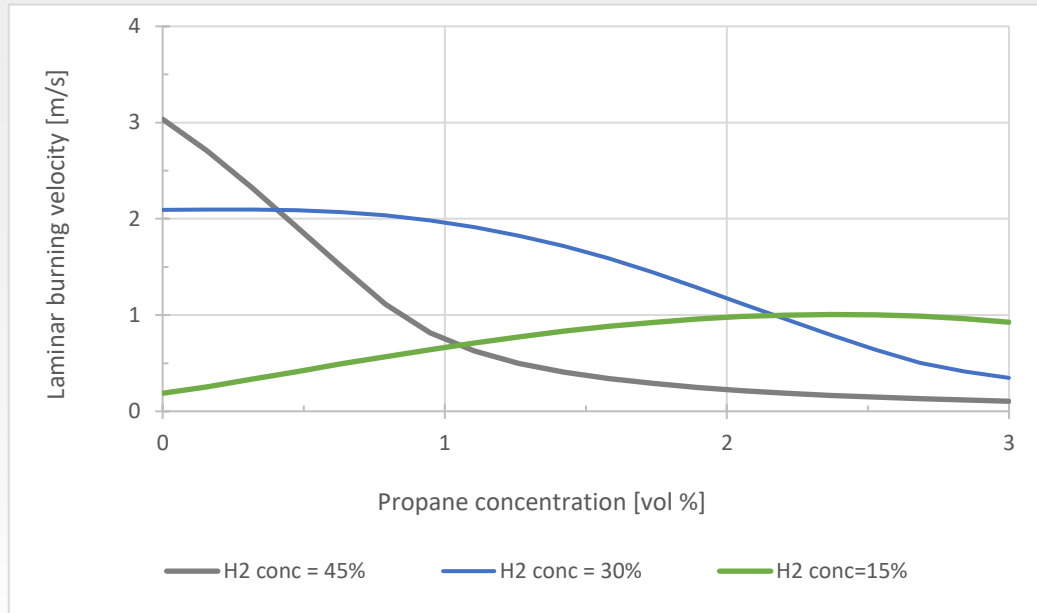
Inhibitors and hydrogen

<i>Inhibitor</i>	<i>Inhibitor added, per cent</i>	<i>Flame speed, cm/sec</i>
<i>1,3-Butadiene</i>	3.58	15*
<i>n-Butane</i>	3.40	19*
<i>Ethyl chloride</i>	3.29	25*
<i>Methane</i>	6.58	25*
<i>Ethylene</i>	4.97	29*
<i>Methyl chloride</i>	3.68	31*
<i>1,1-Difluorethane</i>	3.26	50
<i>Acetylene (undried)</i>	5.15	51
<i>Dibromotetrafluorethane</i>	2.00	54
<i>Ammonia</i>	6.34	59

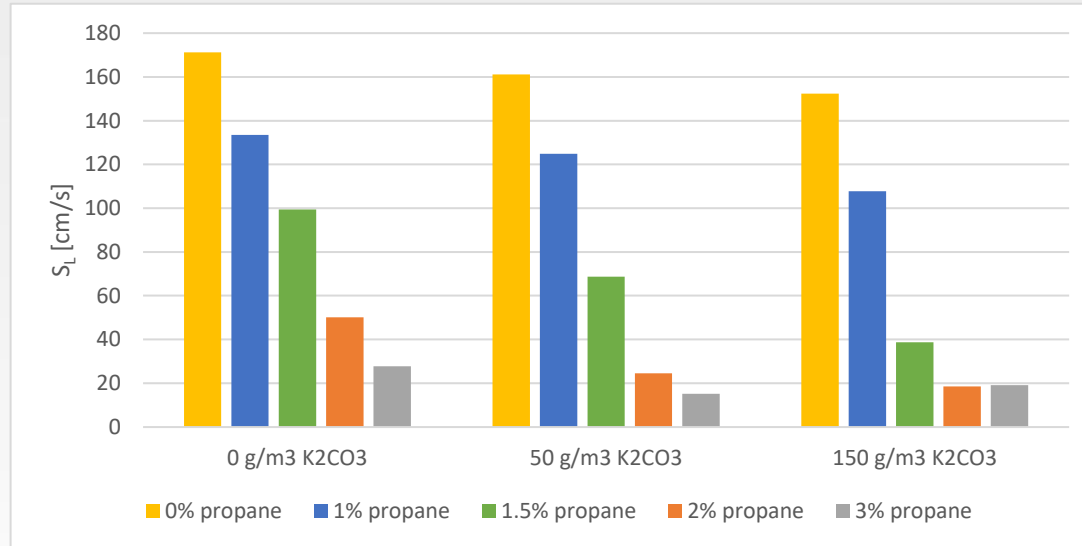
(Miller 1963)



Inhibitors and hydrogen



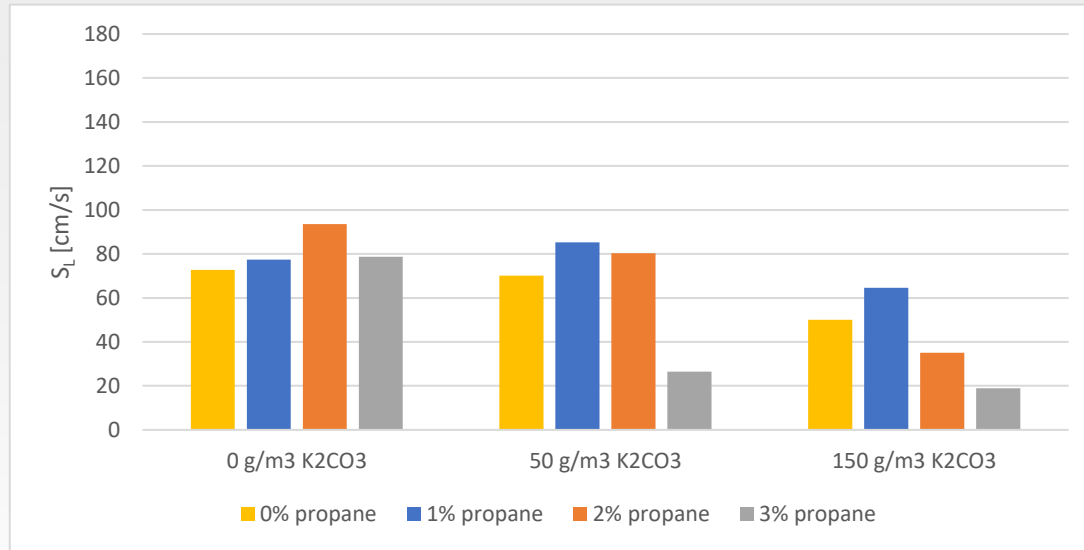
Inhibitors and hydrogen



28% hydrogen – air mixture



Inhibitors and hydrogen



15% hydrogen – air mixture





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