



2ND INTERNATIONAL SYMPOSIUM K-FORCE 2019

Tirana, September 9, 2019

FIRE DYNAMICS AND FIRE CHEMISTRY EXPERIMENTS AT DTU FIRELAB

INTRODUCTION

The Fire Group at DTU Civil Engineering teaches the topics fire dynamics and fire chemistry on a master level and as life-long learning (LLL) courses through our part time master education program "Master in Fire Safety". The theoretical classroom lectures are supplemented with practical fire lab exercises, to deepen the understanding of the basic fire phenomena. DTU FireLab developed several experiments to determine some material key parameters important for fire safety engineering and fire risk assessment. These experiments include amongst others, oxygen depletion calorimetry, mass loss cone calorimetry, oxygen bomb calorimetry, time to ignition measurements and flame spread experiments.

Laboratory exercises on fire chemistry and fire dynamics

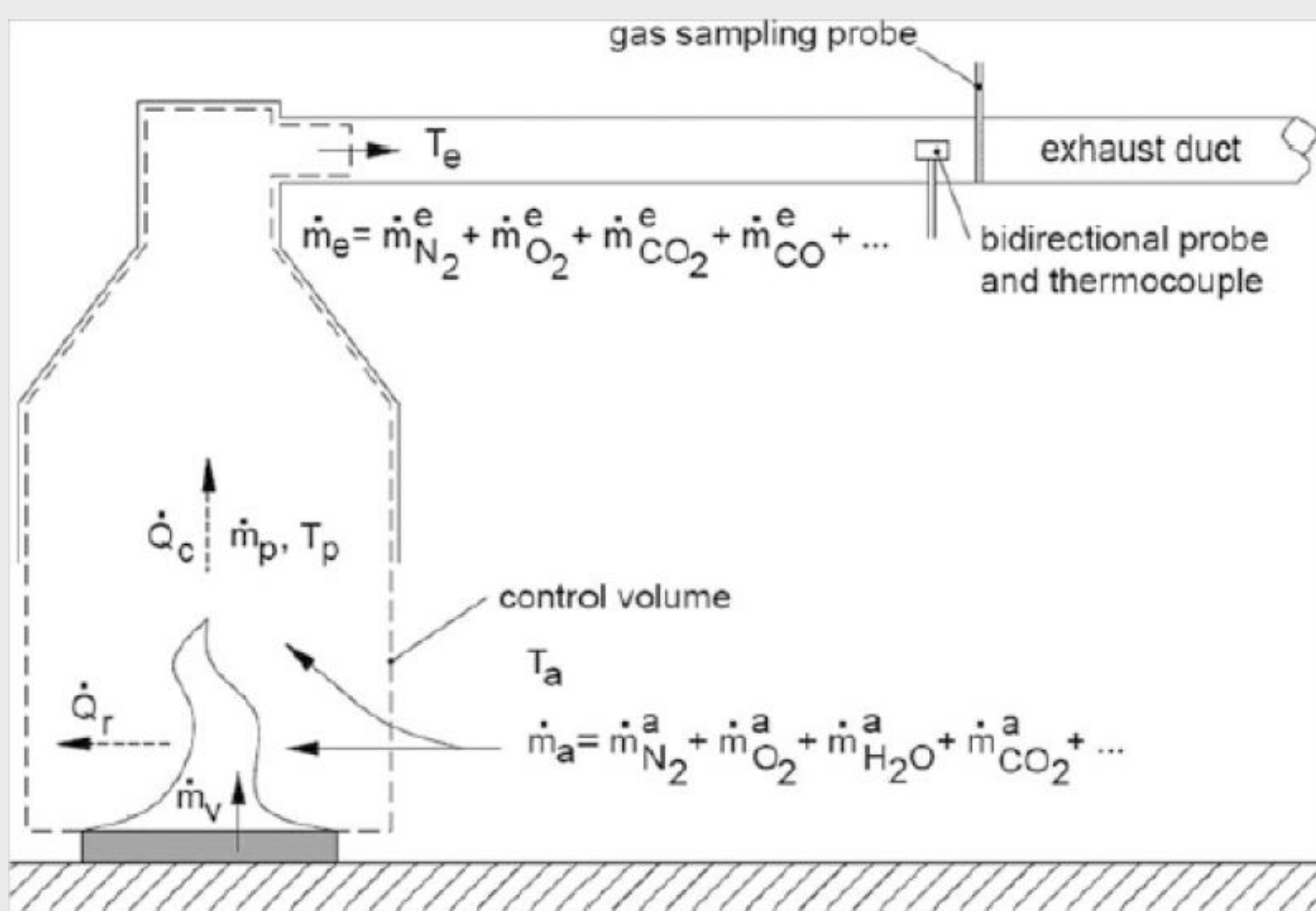


Figure 1 – Drawing of the heat and mass balance, to determine the amount of oxygen combusted in the pool fire (Janssen's method)

$$\dot{Q} = E (\dot{m}_a Y_{O_2}^a - \dot{m}_e Y_{O_2}^e)$$

$$\dot{m}_e = C \sqrt{\frac{\Delta p}{T_e}} = \frac{A k_c}{f(Re)} \sqrt{2 \rho_e \Delta p}$$

$$\Delta p = \frac{1}{2} \rho_e [f(Re) v_c]^2$$

Q = heat flow rate;
 $E = 13100 \text{ kJ/kg } O_2$
 m = mass flow rates;
 Y = mass fractions;
 C = constant; p = pressure;
 T = temperature; ρ = density;
 Re = Reynolds number; v = velocity;
 $f(Re)$ = function term

Figure 2 – Equation describing the depletion of oxygen during a combustion process

Pictures of the experiments setup

Cone calorimeter setup
(time to ignition)



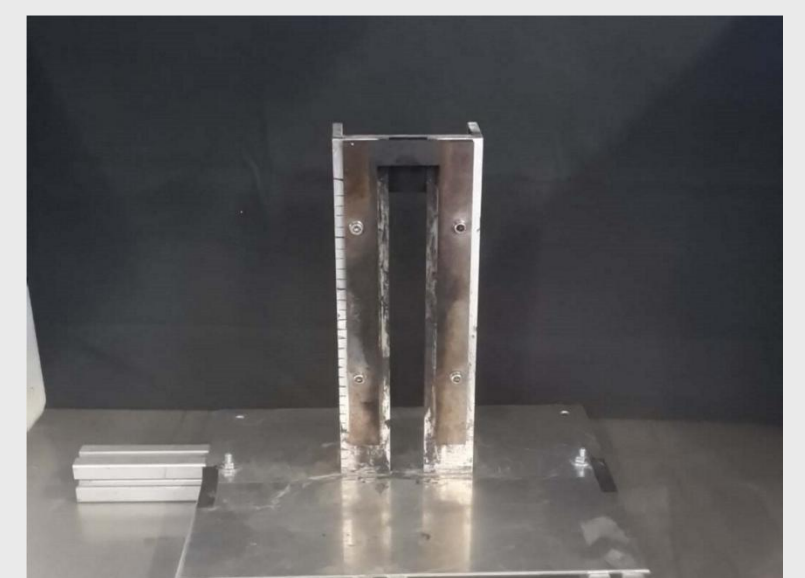
Liquid pool fire setup



Bomb calorimeter parts



Setup for the flame spread experiments



The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

FRANK MARKERT and LARS SCHIØTT SØRENSEN
DTU Civil Engineering

¹Associate Professor, fram@byg.dtu.dk

²Associate Professor, DTU Civil Engineering, Lsso@byg.dtu.dk



Co-funded by the
Erasmus+ Programme
of the European Union

