ZELDOVICH-VON NEUMANN-DORING MODEL OF DETONATION USED FOR COMPUTING INDUCTION TIME

Computational methods in combsution

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Contents

1 Introduction

The purpose of the study was to calculate the proportional constant in relation between induction time and detonation cell size. For hydrogen-air mixture which was study obcject, induciotn time is extremely short and can be considered as zero if the measurment was not accurate enough.

2 Mathematical model

ZND model is also 1-dimensional as C-J however it demarcet between planar shock wave and zone of chemical reactions.
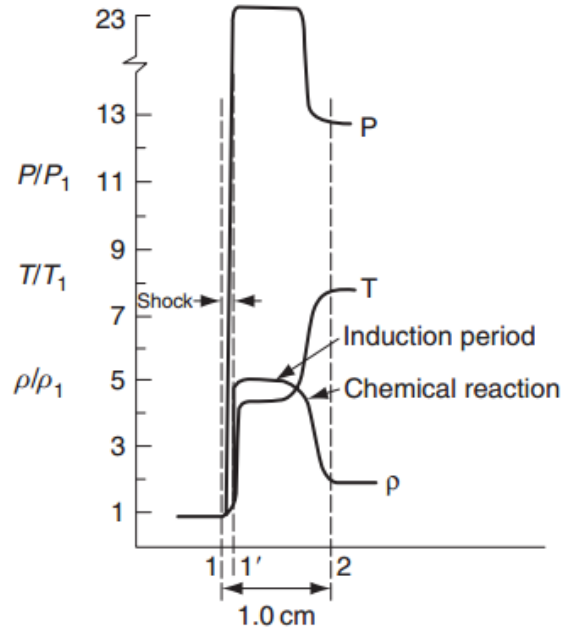

Figure 1: Variation of physical parameters through a ZND detonation wave. source [1]

ZND python code was acquired from [3]

3 Result

Figure 1 shows induction time for hydrogen-air mixture in ϕ function computed using SDToolbox. Comparing it to Figure 2 it is possible to designate:
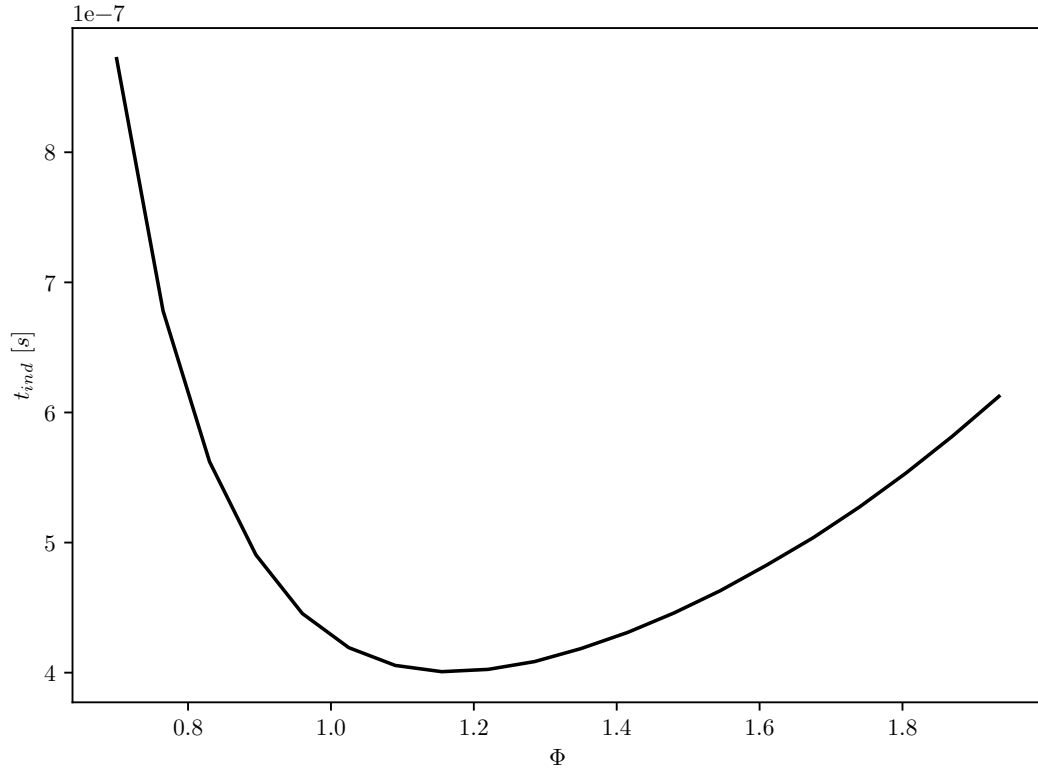
$$a = \frac{t_{ind}}{\lambda} = 3,42536 * 10^-5$$
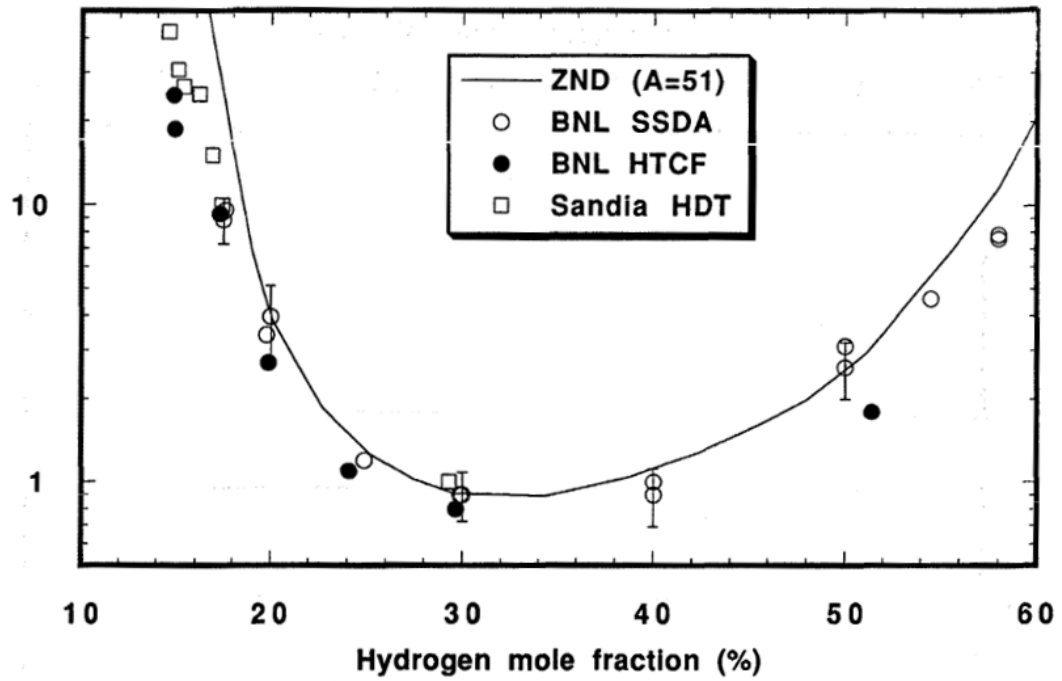
Figure 2: Induction time in function of Φ

Figure 3: Experimental values of detonation size from [2]

References

[1] Irvin Glassman, Richard A. Yetter, *Combustion*, ISBN: 978-0-12-088573-2

[2] *Detonation Cell Size Measurments in High-Temperature Hydrogen-Air-Steam Mixtures at the BNL High-Temperature Combustion Facility*, BNL-NUREG-52482

[3] http://www.shepherd.edu/EDL/public/cantera/html/SDToolbox/ZND.html, SDToolbox