COMMENTS TO THE PAPER „EXPERIMENTAL STUDY OF COMPRESSION AND COMBUSTION PROCESSES IN A VERY SMALL ENGINE" BY P. KALITA, M. RUSINOWSKI AND J. JAROSIŃSKI, PUBLISHED IN JOURNAL OF KONES INTERNAL COMBUSTION ENGINES, 2005, VOL. 12, 1-2

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Abstract

Three comments to the paper mentioned in the above title are presented. First one regards wrong values of measured maximum pressure (after compression), which leads to physically impossible processes. The second one is on the nature of ignition, which is rather not autothermal, as Authors stated. Third one is on the thermodynamic processes presented in Fig. 6.

Keywords: *compression ratio, pressure ratio, polytropic process, isothermal process, ignition*

1. First comment is on data in Table 2

In the Table 2 (page 156) there are given values of maximum compression pressure P_{max} and compression ratio ε. Some of these measured compression pressure are wrong, what leads to conclusions, which are physically impossible.

In the Table there are three different cases:

$$P_{max}/P_o > 1,\ P_{max}/P_o = 1, \text{ and } P_{max}/P_o < 1,$$

The last one is impossible, what is shown as follows:

$$\frac{P_{max}}{P_o} = \pi$$

Compression ratio is from definition

$$\varepsilon = \frac{V_o + V_s}{V_o}$$

where:
V_o – volume over the piston in TDC,
V_s – swept volume.

From equation of state we have:

$$\frac{P_2}{P_1} = \varepsilon \cdot \frac{T_2}{T_1} = \pi$$

where:
T_1, T_2 – are temperatures before and after compression,
$\pi = \frac{P_2}{P_1}$ – pressure ratio after and before compression.
Because P_1= 1 bar, $P_2 = P_{max} = \pi$.

If $P_2 > \varepsilon$, than $T_2 > T_1$ an there is polytropic process, $k > 1$
If $P_2 = \varepsilon$, than $T_2 = T_1$ an there is isothermal process, $k = 1$
If $P_2 < \varepsilon$, than $T_2 < T_1$ an there is polytropic process with $k < 1$

The last case is impossible, because the temperature of the end of compression would by lower than atmospheric temperature.
So the case: F and G in the Table 2 are impossible!

2. Second comment on ignition

Ignition of the combustible mixture is completed by the hot surface of spiral wire (catalytic material of it only assists ignition).

3. Third comment is on Fig. 6

What process does the line 3-4 in the Fig. 6 represent? Heat rejection and work? There is no information on engine efficiency.

In Stirling process line 3-4 represents isothermal process, during which work is done and line 4-1 represents expansion at V = const when heat is recovered and transmitted to the process 2-3.