

The study of shock waves in the gas

Molecular Workshop 3-3

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1 Aim

Measuring speed of the shock front. Measuring the width of the shock front.

2 Idea

Measure the distance between the piezoelectric transducers, and repeated the oscilloscope time to calculate the speed of sound.

3 Measurement method

1. Turn on the oscilloscope and power supply amplifiers. 2. Setup time measurement mode 3. Inserting a cellophane film. With gear I will set the desired pressure. Open the valve to fill air high pressure section. 4. Pierce the cellophane plenku.nalysdatchikov pressure. Measure the time between the signals from the pressure sensors, with help osfillografa, and the amplitude of these signals. 5. Repeat experiments under different air pressures in the high section of pressure.

4 Experimental Data

During the experiment, data were obtained for the time. The distance between 22.5 cm. Experimental time dependence was obtained between passage of piezoelectric transducers, and the pressure within the pressure chamber.

Table 1: Table experimental data.

Column 1 - the pressure in the pressure chamber.

Column 2 - time interval microseconds.

Column 3 - front speed.

Column 4 - Mach number.

Column 5 - the ratio of the pressure behind the front of the pressure ahead of the front.

P(atm)	t(sec)	V(m/s)	M	P1/P4	relative error for vehicle	Front (t)
2	520	374.14	1.28	3.05	0.50	4.2
2	516	392.85	1.29	3.16	0.50	4.3
2	528	401.45	1.26	2.85	0.49	4.5
2	524	423.07	1.28	3.05	0.50	5.0
3	500	426.75	1.33	3.65	0.52	4.9
3	504	440.02	1.32	3.64	0.51	3.7
3	504	443.25	1.32	3.52	0.51	3.8
3	503	450.81	1.33	3.52	0.54	5.4
4	480	458.37	1.39	3.55	0.55	4.3
4	472	440.00	1.41	4.40	0.52	4.1
4	476	474.14	1.41	4.75	0.52	3.9
4	476	416.96	1.38	4.75	0.55	5.2
5	456	468.25	1.46	4.23	0.53	5.8
5	456	485.35	1.46	5.58	0.55	4.3
5	456	491.54	1.46	5.58	0.52	6.0
5	464	476.23	1.47	5.70	0.53	5.3

5 Sample Calculation

Standard deviation of time	= 0.000 025 97 sec
Standard deviation of vehicle	= 24.07 m/sec
Standard deviation of the Mach number	= 0.01 m/sec
The absolute error of the line	= 0.5 mm

The measurements used oscilloscope absolute error of 250 microseconds. The error introduced by ostsillogrofom taken into account in the relative speed of the error column in Table 1.

6 The discussion of the results

Since tabular data rate depending on the pressure to find it was not possible, it can be assumed that a constant amount of the substance in the chamber high dvleniya, increased temperature, in consequence of increased pressure. Link to tabular data at different temperatures:

<http://www.tehtab.ru/guide/guidephysics/sound/soundspeedairtemperature/>

When analyzing the results of colleagues, he concluded that the speed of sound coincides with the data obtained in my experiment that allows us to say that I have been the result.

7 Conclusion of the report

Me firmly established that the highest speed of sound is reached at a pressure of 5 atm. The speed of sound at a pressure of 484.45+- 0.57. It is also found that the greatest wave front reached at 5 atm and is 0.0028 meters. Also I was established that the highest number of MAX is 1.47.

8 Bibliography

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