Shock wave propagation across the column of dusted glow discharge in different gases

A.S.Baryshnikov, I.V.Basargin, M.V.Chistyakova

Ioffe Physico-Technical Institute,
S.Petersburg, 194021, 26 Politechnicheskaya
E-mail: al.bar@mail.ioffe.ru

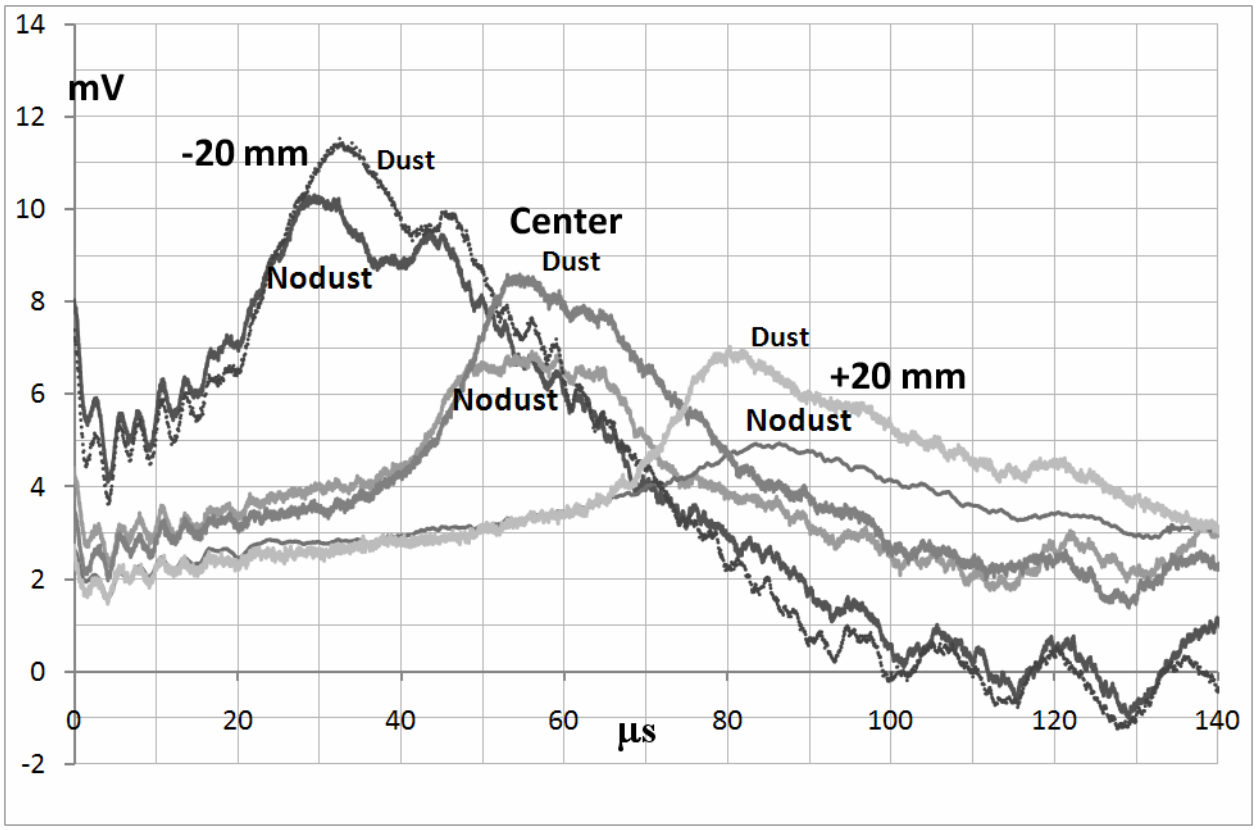
Experiments were conducted on the electric discharge installation of Ioffe Institute of Russian Academy of Science in the trans-sonic regimes of shock wave propagation. Such regimes with difficulty yield to numerical simulation, those more in the plasma, and at the same time precisely these regimes are interesting for the practice. The experimental form of the distribution of pressure after shock wave in the plasma differs significantly from form in the gas without the plasma. “Two-wave” form in the plasma makes it possible to hope for reductions in the expenditures of energy of the gas motion for an increase in the entropy in the shock wave, as this occurs also in the case of the mechanical method of splitting wave, for example on the conical surfaces.

Experiments are carried out for the careful study of the distribution of pressure behind the shock wave during its propagation across the positive column of the steady-state glowing discharge in the dust-laden air, and also in nitrogen and in argon. Experiments in nitrogen and argon are needed for the comparison and, ultimately, to understand the mechanism of the effect, without which it is difficult to provide reliable practical recommendations. Dust represents nanosize carbon particles.

Previous studies have shown that the influence of dust is significant for increasing the concentration of dust at 10 times in comparison with the natural dust, influence heavily depending on the

speed of the wave. More thorough study using the modernized installation with modern electronic equipment improved the results on influence of large concentrations of dust on researched effect. In modernized installation the numbers of points of registration in the distribution of pressure behind the shock wave have increased in 10 times.

Experimental results were quite surprising. The influence of high concentrations of dust was seen only for argon in plasma, despite of high molecular weight of argon. In nitrogen and in the air, influence in plasma practically is not observed. Perhaps the energy of motion of the particles of dust in the case of plasma is in equilibrium with vibration levels of nitrogen and oxygen. The influence in all gases without plasma is in limits of experimental accuracy. As to plasma (Fig.1) the influence in argon is limited to an increase in the second peak, but does not affect the time characteristic - distance behind the shock wave at which secondary wave occurs. Primary wave as in the case without plasma is not changed. Possibly second wave has another nature than primary shock wave. **Fig.1.** Glow discharge in Argon.


mV
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4
2
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-2
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40
60
80
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140
µs
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