THE FLOW FIELD DEVELOPED BEHIND A STRONG NORMAL BLAST WAVE PROPAGATING INTO A WATER DROPLETS-ARGON SUSPENSION

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The propagation of strong normal shock waves into quiescent gas seeded with water droplets is studied. For evaluating the effects of the water droplets on the post shock wave flow filed, i.e., the relaxation zone, the conservation equations appropriate to a steady, one-dimensional suspension flow are formulated and solved numerically. The solution was carried out for a range of shock Mach numbers $13 < M < 17$ and a few different values for the water droplet concentration.
The introduction of water droplets into the second shocked gas have a marked effect on the post-shock flow field. For the monatomic gas studied (A) it was shown that:

1. The introduction of a minute amount of water droplets into argon gas will have a marked effect on the extend of the obtained relaxation zone. The most plausible reason for this significant reduction in the relaxation zone length is the pressure of hydrogen atoms.

2. The post-shock wave temperature suffers a meaningful reduction, in comparison with the pure gas case, due to heat absorbed by the water drop-lets during evaporation and dissociation. For the relatively high water concentration (h=0.05) temperature reductions as high as 30%, relative to the pure gas case (h=0) can be observed immediately downstream of the shock front. On the other hand, the reduction in the equilibrium temperature due to droplet pressure is more than moderate, only about 5%.

3. The presence of water droplets will cause an increase in the post-shock plasma velocity and a decrease in density and pressure. The increase in the plasma velocity is due to the momentum transferred from the droplets to the gaseous phase upon evaporation. As h decreases r and P increase while u decreases.