

NUMERICAL INVESTIGATION OF CARBON COMBUSTION BEHIND NORMAL SHOCK WAVES

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The flow field induced by a normal shock wave propagating into a quiescent suspension composed of oxygen gas and carbon dust was investigated. The conservation equations describing such flows were formulated and solved numerically using the Flux Corrected Transport (FCT) technique. Depending upon the strength of the incident shock wave, the post-shock gas temperature could reach the carbon ignition temperature. Had this happened, the carbon particles ignited and their combustion continued until they completely burnt out. This combustion process affected the post shock flow properties. It increased the gas pressure and temperature and reduced its velocity in comparison with a similar inert suspension case. In addition it was found that increasing the carbon loading ratio in the suspension resulted in an increase in the post-shock suspension pressure and temperature due to the increase of the energy released during the carbon combustion. The temperature increase further intensified the combustion process and thereby reduced the extent of the relaxation zone. (The carbon particles are consumed quicker when the carbon loading, in the suspension, increases.)

The carbon dust presence in the suspension caused the incident shock wave to attenuate. Increasing the carbon loading ratio increased the shock wave attenuation, in spite of the increase in the thermal energy released during combustion process behind the shock wave.