

Theoretical Calculation for Overpressure of Air Shock Wave of explosion induced reaction of Reactive material case

Ning Du, X F Zhang, W Xiong, J P Wang, H H Chen and B Y Huang
School of Mechanical Engineering, Nanjing University of Science and Technology
E-mail address: duning521519@126.com

In order to study the power of the air shock wave produced by the reactive materials driven by explosion, the reaction behavior of the reactive materials driven by explosion was analyzed by AUTODYN@ software, and the reaction law of the reactive materials was obtained. Considering the chemical energy released by the reactive materials, the calculation model of shock wave initial parameters is improved. Combined with dimensional analysis, the theoretical calculation model for overpressure of air shock wave generated by the reactive materials driven by explosion is studied. The results show that, under the driving of explosion, the casing made of the reactive materials does not react completely. The velocity of air shock wave produced by the charge with reactive materials casing is higher than that of the charge with inert material casing. The predicted value of the theoretical calculation model is in good agreement with the experimental results, and the established model can well describe the attenuation law of the air shock wave overpressure generated by the reactive materials driven by the explosion.

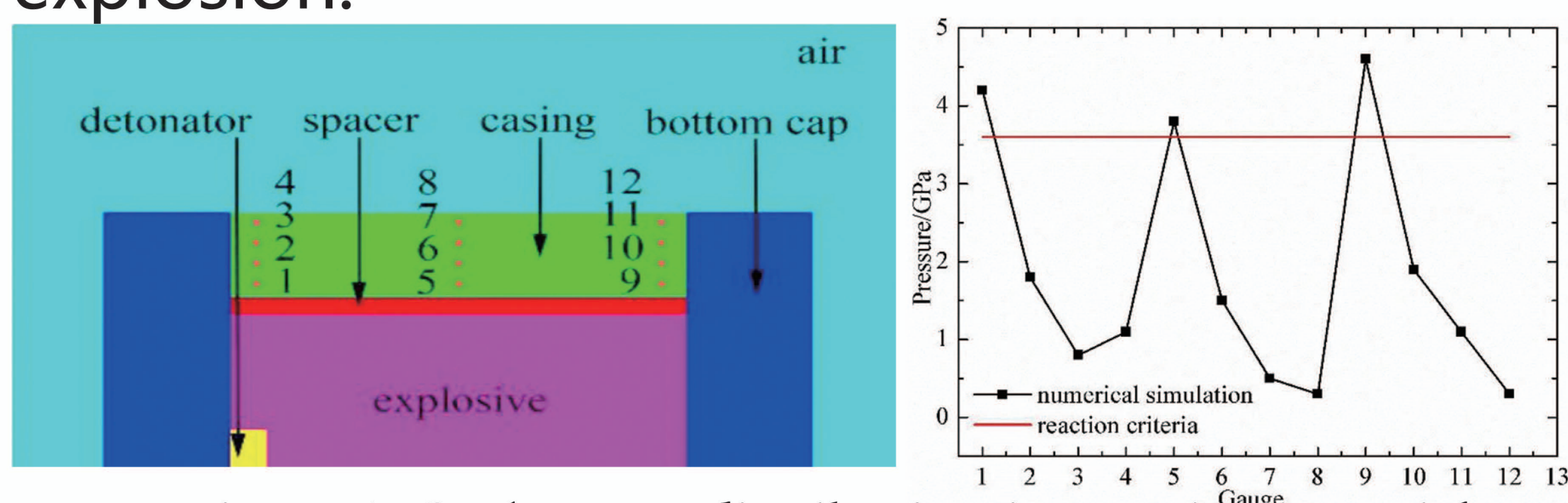


Figure 1. Peak stress distribution in reactive materials

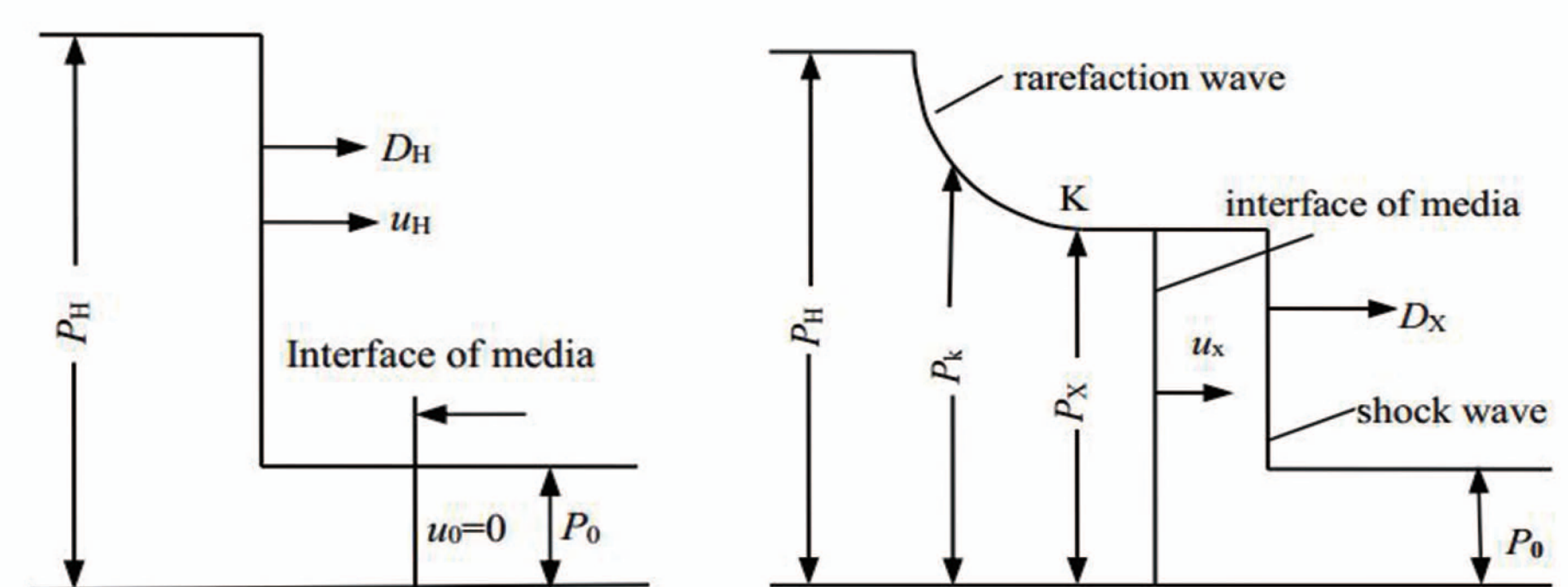


Figure 2. Initial shock wave parameters

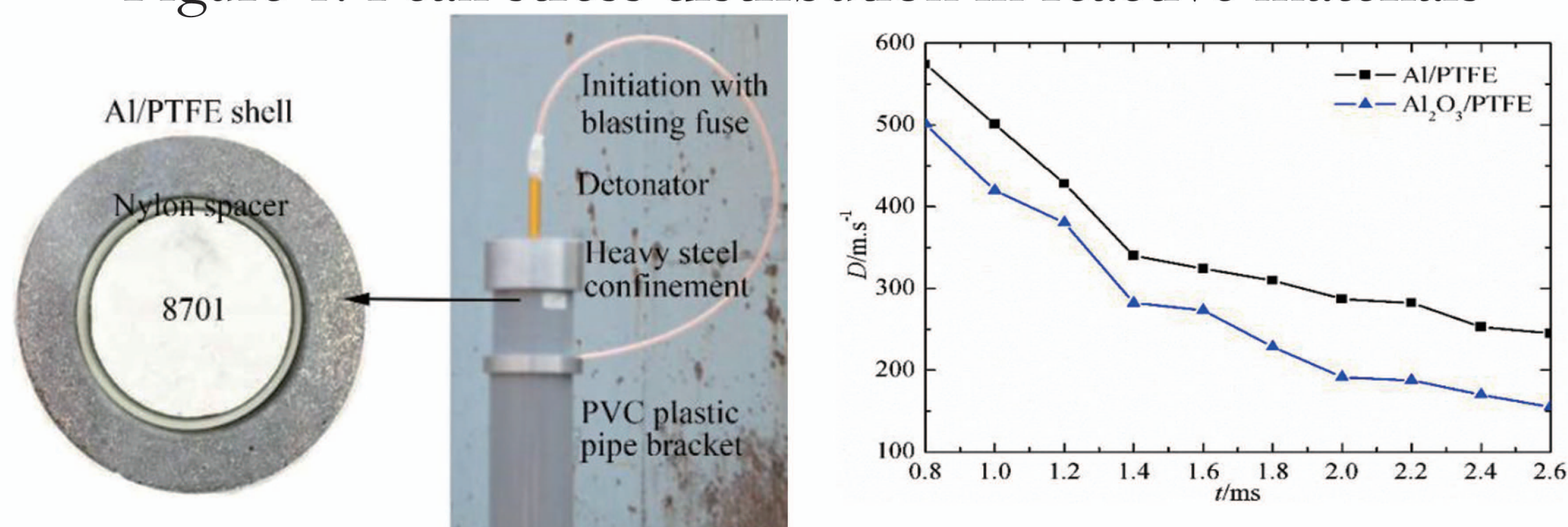


Figure 3. Velocity of shock wave changes with time

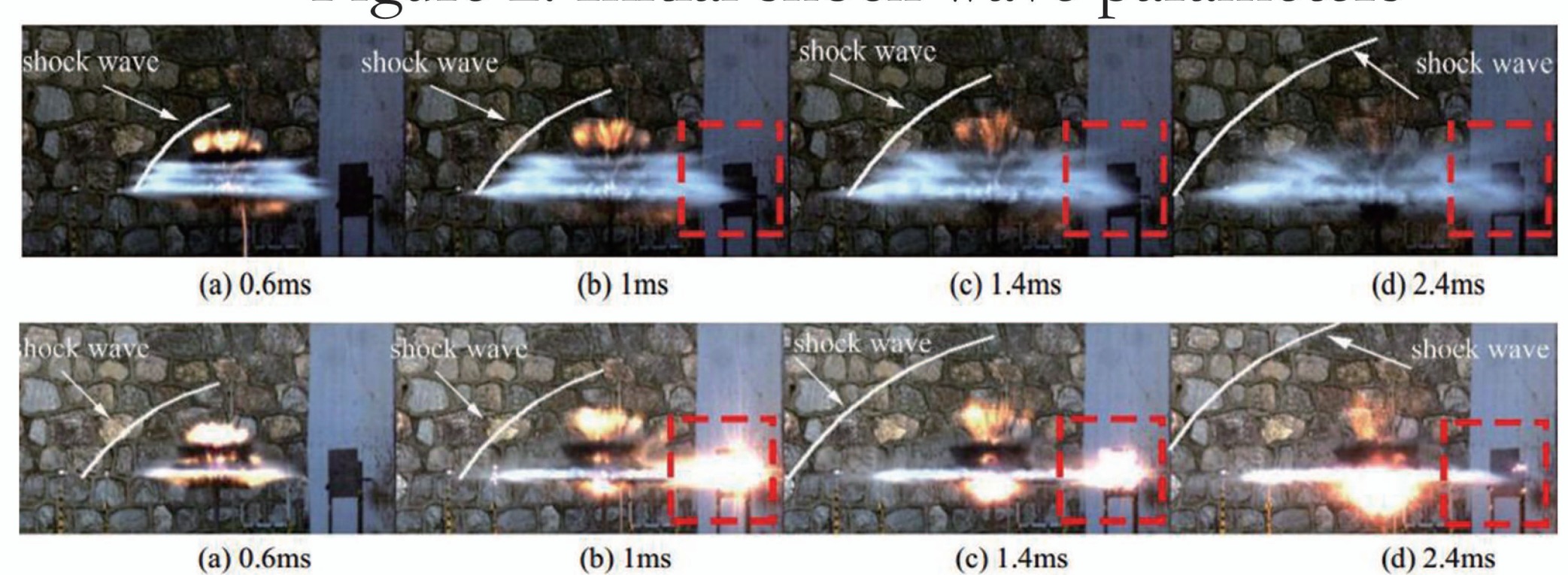


Figure 4. Propagation of Air Shock Wave Driven by Al₂O₃/PTFE and Al/PTFE Explosion

Conclusion

- (1) The casing made by Al/PTFE material does not react completely under explosive driving. The numerical simulation results are consistent with the experimental results, which shows that the numerical simulation method and material model parameters used in this paper are reliable. The unreacted fragments fly around, impact the steel plate during the process of flying and react subsequently. The velocity of air shock wave produced by the charge with reactive materials casing is higher than that of the charge with inert material casing.
- (2) The calculation model of the peak value of air shock wave overpressure established in this paper can well describe the propagation law of air shock wave generated by reactive materials, and provide theoretical support for the evaluation of the power of air shock wave produced by reactive materials driven by explosion.