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Analysis of VOD-diameter data using an analytical two-dimensional non-ideal detonation model SEK CHAN, Orica Canada Inc., IAN KIRBY, retired — An analytical two-dimensional detonation model is described that has successfully used experimental VOD-diameter data to determine the ignition and growth behaviour of a highly non-ideal explosive. The model is based on a first order approximation of two-dimensional cylindrically symmetric steady state ZND detonation theory. A new ignition and growth model describes the kinetics. Previous analytical methods for analysing highly non-ideal explosives have used quasi-one dimensional models that determine the curvature of the shock front on the axis, and then require empirical relationships to determine the charge diameter. Consistency checks, and comparison with a hydrocode, suggest that the inaccuracies introduced by the first order approximations and assumptions of the model cause overall errors of less than 10%. The model was verified by a series of experiments on an emulsion explosive. Data on detonation velocity, particle velocity and shock front curvature, as a function of charge diameter, were measured in these experiments. It is shown that three parameters defining the ignition and growth are both necessary and sufficient for matching to the experimental VOD-diameter data. The model uses these parameters to predict the shock front and particle velocity profiles, both of which agree with the experimental data to within the estimated errors.

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