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Effect of the oxygen balance on ignition and detonation properties of liquid explosive mixtures MARC GENETIER, ANTOINE OSMONT, GERARD BAUDIN, CEA, DAM, Gramat — The objective is to compare ignition and detonation properties of various liquid high explosives having negative up to positive oxygen balance (OB): nitromethane (OB <0), saccharose and hydrogen peroxide based mixture (quasi nil OB), hydrogen peroxide with more than 90% purity (OB >0). The decomposition kinetic rates and the equations of state (EOS) for the liquid mixtures and detonation products (DP) are the input data for a detonation model. EOS are theoretically determined using the Woolfolk et al universal liquid polar shock law and thermochemical computations for DP. The decomposition kinetic rate laws are determined to reproduce the shock to detonation transition for the mixtures submitted to planar plate impacts. Such a model is not sufficient to compute open field explosions. The aerial overpressure is well reproduced in the first microseconds, however, after it becomes worse at large expansion of the fireball and the impulse is underestimated. The problem of the DP EOS alone is that it takes into account only the detonation, the secondary combustion DP – air being not considered. To solve this problem a secondary combustion model has been developed to take into account the OB effect. The detonation model has been validated on planar plate impact experiments. The secondary combustion parameters were deduced from thermochemical computations. The whole model has been used to predict the effects of the oxygen balance on open air blast effects of spherical charges.

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