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EFFECTS OF EFP SOLIDITY IN TERMINAL BALLISTICS

H. S. Kim[1], W. Arnold[2], T. Hartmann[3], E. Rottenkolber[3], A. Klavzar[4]

[1]*ADD Agency for Defence Development, South Korea*
[2]*TDW Gesellschaft für verteidigungstechnische Wirksysteme, Germany*
[3]*Numerics GmbH, Germany*
[4]*ISL French-German Research Institute, France*

ABSTRACT

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Since the last two decades many experimental and numerical studies have been carried out in order to improve the final shape of EFPs for both stability and penetration performance. Improving the final EFP shape and especially the solidity (i.e. the ratio of solid volume to the volume determined from the maximum dimensions) of the EFP usually involves lower projectile velocities as a large amount of energy is imparted for plastic deformation instead of kinetic energy [1]. For an optimization it is therefore of interest to investigate the penetration performance of hollow projectiles at high velocities.

Experiments have been conducted with different solidity tantalum EFP simulants. The projectiles were shot at mild steel targets at velocities of 2000 m/s and 3000 m/s (see Figure. 1).

Figure 1: Experimentally studied EFP simulants (left), EFP prior to impact (middle) and test result (right)

The experimentally measured depths of penetration (DoP) and crater diameters were evaluated and compared to the results of numerical simulations. It could be found from both experiments and simulations that there is a nearly linear decrease of penetration performance with decreasing solidity.

In order to broaden the regarded range of EFP solidities and impact velocities, additional numerical simulations were carried out. These simulations revealed that the linear relation also holds for solidities down to 20% and for impact velocities from 1000 m/s to 4000 m/s.

However, the influence of EFP solidity on the DoP is different for different impact velocities (Figure 2). Furthermore, a detailed analysis of the penetration process revealed significant similarities between the influence of solidity and the L/D effect known from long rod impact [2].

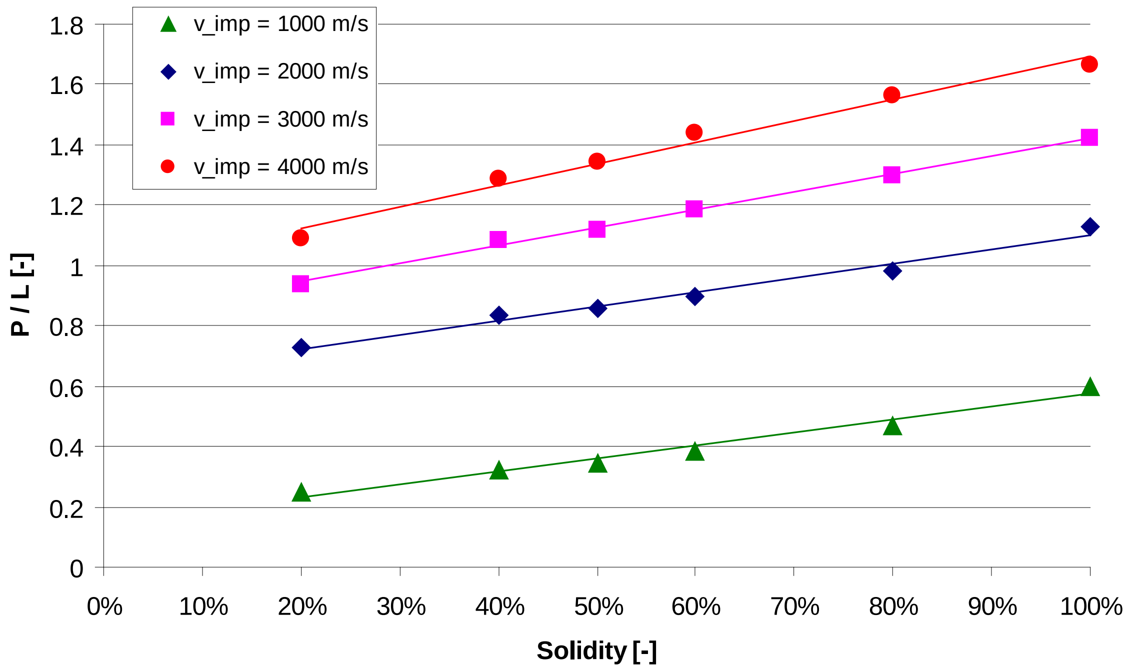

Figure 2: Penetration performance vs. EFP solidity for different impact velocities

In a second step the influence of solidity in yawed and oblique impact was studied in further numerical investigations. Taking into account the results from normal impact without yaw, the effects of solidity in non-ideal impact could be quantified.

These findings will be used as a basis for the extension of existing analytical and semi-empirical models for rod penetration to an application to hollow EFP impact.

REFERENCES

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