Optimization of an Explosive Mixture Cooling Process Including a Phase Change

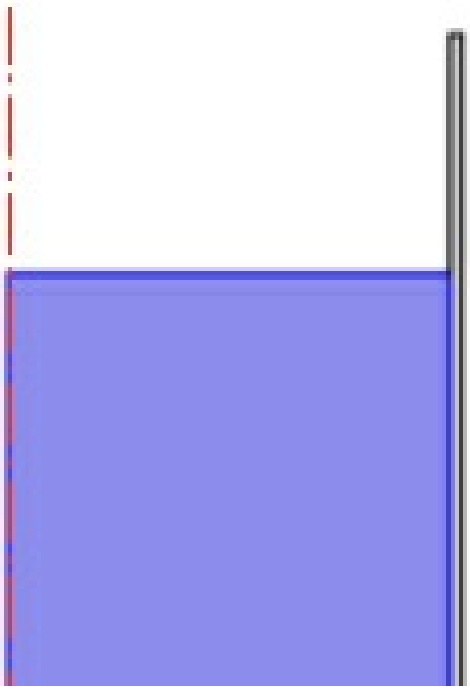
J.-D. Wheeler[1], P. Namy[1], C. Coulouarn[2], E. Benade[2]

[1]SIMTEC
[2]TDA Armements

Abstract

In the scope of improvement of the industrial "ammunition cooling" process, a COMSOL Multiphysics® model is developed to transfer an existing cooling process. A device filled with a liquid explosive mixture is placed in an apparatus which controls the environment temperature.
This explosive mixture undergoes a phase change during the cooling and the solidification enthalpy is introduced to the model thanks to the "modified heat capacity" method.
The apparatus allows for cooling the device from its bottom to its top and therefore to ensure a continuous and unique solidification front. While the air surrounding the top of the device is heated, the bottom of the device is either soaked in water or cooled via a high velocity air flow. Thanks to the modeling approach, the industrial transfer had been optimised, by minimising the cooling time.
A user-interface is developed to allow the users of the model to easily vary the cooling conditions and the device geometry. COMSOL Server™ enables a remote computing to the users, thanks to an https secured internet connection.

Figures used in the abstract



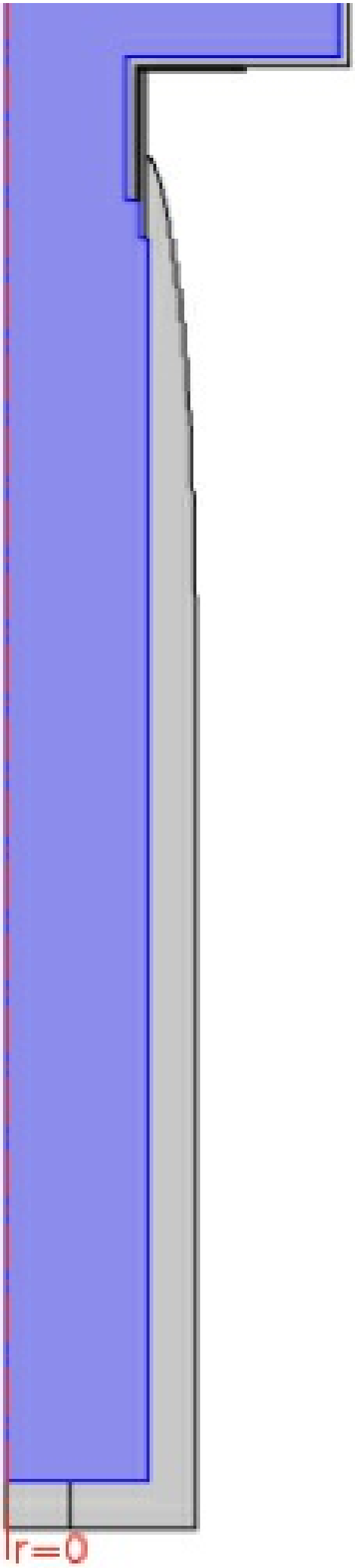

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Figure 1: The device (in gray), filled with the explosive mixture (in purple)