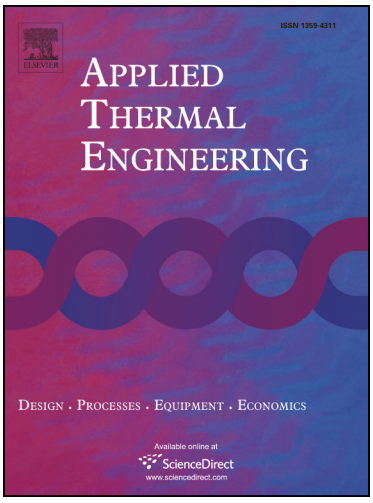

Study on draining off water mechanism and Interaction characteristic of high-temperature and high-pressure combustion-gas jets with the water

Xiaochun Xue, Yonggang Yu, Jiajun Zhao

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Study on draining off water mechanism and Interaction characteristic of high-temperature and high-pressure combustion-gas jets with the water

Xiaochun Xue[a], Yonggang Yu[a,*], Jiajun Zhao[b]

[a.] *School of Energy and Power Engineering, Nanjing University of Science and Technology, Nanjing 210094, China*

[b.] *BSH Electrical Appliances (Jiangsu)Co.,Ltd, Nanjing, 210094, China*

Abstract: A new method of underwater launching is proposed to overcome the water resistance in the barrel and realize continuous launching by forming gas curtain without any complex device. Namely, part of gunpowder combustion-gases behind the projectile is guided to the space in front of underwater projectile by opening pores around the circumference of the warhead, to form a dry launching path. Based on this, the expansion process of combustion-gas jets in the confining tube filled with water, especially complex interaction of high-pressure and high-temperature combustion-gas jets and water is studied by experiments and numerical calculations. The results show that, when the high-velocity combustion-gases inject into motionless liquid environment, multiple Taylor cavities are formed and typical structure of Taylor cavity presents two parts, including bubble head and combustion-gas path. The distribution of the recirculation zone is an important factor for the flow field structure and the effect of draining off water. The recirculation zone of the central jet expands downstream with time going on and is decreasing until it disappears. While, the recirculation zone of lateral jet is strengthening with developing downstream. In the whole expansion process, lateral combustion-gas jet plays a significant role on radial expansion process of Taylor cavities.

Keywords: unsteady flow field; gas-liquid interaction; Taylor cavities; combustion-gas jets

1. Introduction

The present investigation relates to a method for underwater gun and, more particularly, to a new method of continuous launching projectiles that utilize ventilation projectile forming the gas curtain passage in the gun barrel to simplify the structure of the vehicle itself and to enhance the performance of the interior ballistic as a projectile moves away from the gun barrel in an underwater environment. It is well known that underwater objects like torpedoes or underwater projectiles cannot reach high speeds due to the existence of friction drag over their body [1]. Supercavitation is a special case of cavitation which can be employed to create a bubble of gas inside the water that is large enough to encompass an object travelling through the water. Supercavitation is a revolutionary step in the direction of underwater locomotion because it can lead to drag reduction of as high as 90%, facilitating a substantial increase in speed [5]. At present, high-speed capability with supercavitation technology has received increased attention, and dramatic advancements have been made [6][7]. These achievements also have been supplemented with information concerning international development [8][9]. Compared with the research on the torpedoes, the high-speed underwater gun can be used to intercept torpedoes, destroy mines, break barriers and deal with frogmen, so more attention is now paid to this underwater gun. While, this existing supercavitation technology mainly concerns drag-reducing in underwater locomotion process after the projectile flies out of the muzzle. As a submerged gun

* Correspondence to: yygnjust311@126.com (Yonggang Yu)