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Experimental Investigation of the Entrained Droplet Velocities in a Submerged Jet Injected into a Stagnant Water Pool

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ABSTRACT

Submerged gaseous jets injected into stagnant water are commonly found in many industrial processes and engineering applications, like underwater propulsion, metallurgical and chemical processes, and nuclear industry.

The high air-water density ratio and the aggressiveness of the pool discharge process result in very complicated flow structures, which are essentially unsteady and turbulent. Consequently, it leads to a challenging issue to measure the different parameters involved in this process.

Round turbulent air jets submerged in stagnant water have been studied experimentally in this paper. To achieve this objective a water pool with an air injector has been built and particle image velocimetry visualization techniques (PIV) have been employed to capture images of the submerged jet throughout its spreading. From these images one of the most important variables that characterizes submerged jets the velocity of the entrained droplets, was determined, finding that the function which best fits the entrained droplet velocity distribution is a decreasing exponential function. In addition, a correlation that relates the initial submerged gaseous jet properties, via the gas Reynolds number, with the entrained droplet velocities was developed, in this case via the entrained droplet Reynolds number.

Keywords: *submerged jet, stagnant pool, entrainment, droplet velocity, entrained droplet, pool discharge*

1. INTRODUCTION

The study of submerged gas jets started in the 70s and 80s caused by increasing interests of the nuclear industry (investigations related with fast breeder reactors) and the metallurgical industry. After this first impulse, another strong push took place in the later part of the twentieth century from the advent of pharmaceutical industries, propulsion systems for underwater propulsion, chemical industries and the support of the nuclear and metallurgical industries. Its interest in the metallurgical industry comes from the wide use of liquid metal

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