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Title

Flash-boiling effect on spray formed by two impinging jets

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Abstract

In the collision of two liquid jets, efficient atomisation and mixing are possible when the streams of injected liquids travel straight along the nozzles' axes and collide precisely at the intersection point. When the liquid streams become wavy or shattered, the collision of the jets emerging from the different nozzles becomes less probable, and the momentum exchange process is less effective. This may happen when a liquid is injected into an environment of pressure lower than its vapour pressure. In that case, rapid vaporisation (flash boiling) occurs, significantly changing the jet's structure at the nozzle's exit. In such conditions, the vapour bubbles generated inside the liquid stream expand rapidly and lead to the jet shattering or even breaking up.

Although flash boiling has been highly interesting to many researchers, and its influence on sprays is relatively well known, the vast majority of the studies have been limited to free sprays. In contrast, the effect of flash boiling on impinging jets is not yet understood.

In this study, we have aimed to fill these knowledge gaps and provide new insight into the global structures of sprays formed by two impinging liquid jets injected under flash-boiling conditions.

The results showed that even moderate flash boiling, in which unbroken liquid columns are still present, changes the global structure of the formed spray cloud. The colliding streams are shattered, and the spray is surrounded by the recondensing vapour. On the other hand, the intense flash boiling changes the jets' interaction from a stream-steam to a spray-spray type. At the same time, the results indicated the need for further research to explain the phenomena behind the differences between the two distinct regimes, which is planned to be carried out in the near future.