The optimal tap: three-dimensional nozzle design

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Abstract

Recently there has been an increased interest in the physics of the generation of small liquid droplets from nozzles (volumes of the order of picolitres), largely motivated by the requirements of high-resolution inkjet printers. The print(er) quality is described in terms of DPI (dots per inch) and the challenge is to reduce the droplet volume so as to pack more dots into the same area. Easiest way to obtain smaller volumes is to reduce the size of the nozzle, but this has already been done and further reductions are seriously limited by pressure and surface tension effects. The researchers here have tried to study and report the effects of nozzle shapes on the droplet volume. Current nozzles are circular in shape. They have used computational techniques to investigate a variety of 2D nozzle shapes and simulate the effects of pressure on the volume of the droplet generated for each of these shapes. They have been able to achieve a reduction on volume of up to 16.75% with a curvilinear triangular shape compared to the circular shape for the same pressure. Going one step further they have studied some non-regular 3D shapes and obtained further reduction of up to 33% in droplet volumes.

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