rate. This in turn has an impact on the print resolution, the printhead size, the print speed and the manufacturing costs.

Summary of the Invention

Accordingly the present invention provides a MEMS vapor bubble generator comprising:

a chamber for holding liquid;

a resistive heater positioned in the chamber for thermal contact with the liquid; wherein, the resistive heater is formed from a superalloy and configured to receive an actuation signal from associated drive circuitry such that, upon actuation, the heater heats some of the liquid to a temperature above its bubble nucleation point in order to generate a vapor bubble that causes a pressure pulse through the liquid.

Superalloys can offer high temperature strength, corrosion and oxidation resistance far exceeding that of conventional thin film heaters (such as tantalum aluminium, tantalum nitride or hafnium diboride) used in known thermal inkjet printheads. Their suitability in the thermal inkjet realm has, until now, gone unrecognized. The primary advantage of superalloys is that they can provide sufficient strength, oxidation and corrosion resistance to allow heater operation without protective coatings, so that the energy wasted in heating the coatings is removed from the design. As a result, the input energy required to form a bubble with a particular impulse is reduced, lowering the level of residual heat in the printhead. The majority of the remaining heat can be removed via the ejected drops, a mode of operation known as "self cooling". The primary advantage of this mode of operation is that the design is not reliant on conductive cooling, so a heatsink is not required and the nozzle density and firing rate constraints imposed by conductive cooling are removed, allowing increased print resolution and speed and reduced printhead size and cost.

Optionally, the chamber has a nozzle opening such that the pressure pulse ejects a drop of the liquid through the nozzle opening.

Optionally the chamber has an inlet for fluid communication with a supply of the liquid such that liquid from the supply flows into the chamber to replace the drop of liquid ejected through the nozzle opening.

Optionally the heater is deposited by a sputtering process such that the superalloy has a nanocrystalline microstructure.

Optionally the heater element is deposited as a layer of the superalloy less than 2 microns thick.

~~Optionally~~Preferably the superalloy has a Cr content between 2% by weight and 35% by weight.

Optionally the superalloy has a Al content of between 0.1% by weight and 8.0% by weight.

Optionally the superalloy has a Mo content of between 1% by weight and 17.0% by weight

Optionally the superalloy has a Nb and/or Ta content totalling between 0.25% by weight and 8.0% by weight.

Optionally the superalloy has a Ti content of between 0.1% by weight and 5.0% by weight.

Optionally the superalloy has up to 5% by weight of reactive metal from the group consisting of yttrium, lanthanum and other rare earth elements

Optionally the superalloy has a Fe content of up to 60% by weight.

Optionally the superalloy has a Ni content of between 25% by weight and 70% by weight.

Optionally the superalloy has a Co content of between 35% by weight and 65% by weight.

~~Optionally~~Preferably the superalloy is MCrAlX, where M is one or more of Ni,Co,Fe with M contributing at least 50% by weight, Cr contributing between 8% and 35% by weight, Al contributing more than zero but less than 8% by weight, and X contributing less than 25% by weight, with X consisting of zero or more other elements, preferably including but not limited to Mo, Re, Ru, Ti, Ta, V, W, Nb, Zr, B, C, Si, Y, Hf.

Optionally the superalloy comprises Ni, Fe, Cr and Al together with additives consisting of zero or more other elements, preferably including but not limited to Mo, Re, Ru, Ti, Ta, V, W, Nb, Zr, B, C, Si, Y, or Hf.

Optionally the superalloy is selected from:

INCONEL™ Alloy 600, Alloy 601, Alloy 617, Alloy 625, Alloy 625LCF, Alloy 690, Alloy 693, Alloy 718, Alloy 783, Alloy X-750, Alloy 725, Alloy 751, Alloy MA754, Alloy MA758, Alloy 925, or Alloy HX;

INCOLOY™ Alloy 330, Alloy 800, Alloy 800H, Alloy 800HT, Alloy MA956, Alloy A-286, or Alloy DS;

NIMONIC™ Alloy 75, Alloy 80A, or Alloy 90;