

## VF<sub>2</sub>/VF<sub>3</sub> Copolymer Line Hydrophone and Line Hydrophone Array for Ultrasonic Measurement

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Line hydrophones and a line hydrophone array for measuring the spatial and temporal characteristics of medical ultrasonic transducers have been fabricated using a polyvinylidene fluoride/trifluoroethylene (VF<sub>2</sub>/VF<sub>3</sub>) copolymer. Copolymer films are cast by melt extrusion onto fine wires (114  $\mu\text{m}$  diam. and 60  $\mu\text{m}$  diam.). Fine wires are used in order to provide high spatial resolution in the ultrasonic field measurements. A saline bath is used as the ground electrode in poling the copolymer lines. The construction and performance of the line hydrophones and the 23-element line hydrophone array are reported. As the output of a line hydrophone is proportional to the line integral of the acoustic pressure, a computer tomographic technique is used to reconstruct the pressure profiles. The beam profile of a hyperthermia transducer has been measured using the line hydrophones, the line hydrophone array and a spot-poled membrane hydrophone, and the results are compared.

### 1. Introduction

In order to determine the spatial and temporal characteristics of an ultrasonic field, a hydrophone<sup>(1)</sup> or a hydrophone array<sup>(2)</sup> is required. If a two-dimensional array is used, mechanical scanning of the hydrophone is not required and it is possible