Design of Ultrasonic MEMS Temperature Sensor Using COMSOL Multiphysics ® Software

S. K. Kamilla[1], G. Parag[1], H. Tripathy[1], P. Pattanaik[1]

[1] Semiconductor Research Lab, ITER, Siksha 'O' Anusandhan University, Bhubaneswar, Odisha, India

Abstract

The attempt has taken to miniaturized size of non contact temperature sensor by using ultrasonic trans-receiver. The piezoelectric material is used in both transmitter and receiver ends for this ultrasonic Micro-Electronics Mechanical Systems (MEMS) based temperature sensing device. Prior to fabrication of ultrasonic MEMS device, design and simulation are extensively used to avoid wastage of time and test the workability of a system without much expenditure. COMSOL Multiphysics® is a versatile tool and is used to design and solve the transducer device with 3D partial differential equations.

In this paper, 2D axi-symmetric model geometry of piezoelectric transducer is designed with Quartz (SiO2) which is capable of being used as thin film. By varying thickness of the piezoelectric thin film of the transmitter as well as receiver, the dimension was optimized to produce maximum transmitting pressure. The proposed device relies on the propagation of 40 KHz ultrasonic waves in air medium and the decreasing density of air with increasing temperature. So it would affect the generated pressure and received potential of both transmitting and receiving end of piezoelectric material with respect to changing temperature. This indicates that by using this principle one can design and fabricate high temperature sensing devices.