Modeling of MEMS Based Bolometer for Measuring Radiations From Nuclear Power Plant

S. Nisitha[1], T. Satyanarayana[2], S. Sreeja[1]

[1]Department of EIE, Lakireddy Bali Reddy Engineering College, Mylavaram, Andhra Pradesh, India.

[2]NPMASS Centre, Department of EIE, Lakireddy Bali Reddy Autonomous Engineering College, Mylavaram, Andhra Pradesh, India

Abstract

High performance micro sensors are important for detecting nuclear radiations in different fields to save the globe. Nuclear reactors produce large quantities of ionizing radiation. During normal operations of nuclear power plant, penetrating radiation (like gamma and X-rays) emitted from the radioactive materials in the reactor and in the systems and buildings of the plant may be able to expose someone outside the boundary of the plant where ionizing radiation is invisible and not directly detectable by human senses. Nuclear radiation accounts for about 0.16% of total ionizing.

This paper is mainly focused to develop a MEMS based bolometer for detecting the nuclear radiation to provide high security around nuclear power plants and also to improve the performance of the bolometer by updating geometry and by studying different metal pairs. Two thermally sensitive micro metal plates of different coefficient of expansion are held together and placed on both sides of a link connected to the substrate. The energy of the incident radiation heats the micro plates which make them to deflect. Copper links are provided on either side of the substrate. The deflection contacts with the copper links and the changes the voltage across it. By measuring the voltage, the frequency of incident radiation can be determined. The micro plate and micro thermal links are designed and simulated using COMSOL Multiphysics' Heat Transfer physics and Solid Mechanics physics.

Keywords: Coefficient of thermal expansion (CTE), MEMS, Nuclear radiations