

# Amorphous SiC/c-ZnO-Based Quasi-Lamb Mode Sensor for Liquid Environments

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**Abstract:** The propagation of the quasi-Lamb modes along a-SiC/ZnO thin composite plates was modeled and analysed with the aim to design a sensor able to detect the changes in parameters of a liquid environment, such as added mass and viscosity changes. The modes propagation was modeled by numerically solving the system of coupled electro-mechanical field equations in three media. The mode shape, the power flow, the phase velocity, and the electroacoustic coupling efficiency ( $K_2$ ) of the modes were calculated, specifically addressing the design of enhanced-coupling, microwave frequency sensors for applications in probing the solid/liquid interface. Three modes were identified that have predominant longitudinal polarization, high phase velocity, and quite good  $K_2$ : the fundamental quasi symmetric mode ( $qS_0$ ) and two higher order quasi-longitudinal modes ( $qL_1$  and  $qL_2$ ) with a dominantly longitudinal displacement component in one plate side. The velocity and attenuation of these modes were calculated for different liquid viscosities and added mass, and the gravimetric and viscosity sensitivities of both the phase velocity and attenuation were theoretically calculated. The present study highlights the feasibility of the a-SiC/ZnO acoustic waveguides for the development of high-frequency, integrated-circuit compatible electroacoustic devices suitable for working in a liquid environment.

**Keywords :** Lamb Modes, Amorphous SiC, Coupling configurations, sensors, viscous liquids