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Amorphous SiC/c-ZnO-Based Quasi-Lamb ModeSensor for Liquid Environments

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Abstract: The propagation of the quasi-Lamb modes along a-SiC/ZnO thin composite plates wasmodeled and analysed with the aim to design a sensor able to detect the changes in parametersof a liquid environment, such as added mass and viscosity changes. The modes propagation wasmodeled by numerically solving the system of coupled electro-mechanical ?eld equations in threemedia. The mode shape, the power ?ow, the phase velocity, and the electroacoustic couplingef?ciency (K2) of the modes were calculated, speci?cally addressing the design of enhanced-coupling,microwave frequency sensors for applications in probing the solid/liquid interface. Three modeswere identi?ed that have predominant longitudinal polarization, high phase velocity, and quitegood K2: the fundamental quasi symmetric mode (qS0) and two higher order quasi-longitudinalmodes (qL1 and qL2) with a dominantly longitudinal displacement component in one plate side.The velocity and attenuation of these modes were calculated for different liquid viscosities andadded mass, and the gravimetric and viscosity sensitivities of both the phase velocity and attenuationwere theoretically calculated. The present study highlights the feasibility of the a-SiC/ZnO acousticwaveguides for the development of high-frequency, integrated-circuit compatible electroacousticdevices suitable for working in a liquid environment.

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