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Atomic-Layer Deposition for Fabricating Capacitive Micromachined Ultrasonic Transducers: Initial Characterization

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The production of ultrathin membranes facilitates the development of miniature capacitive micromachined ultrasonic transducers (CMUTs), which have potential for use in biomedical imaging applications. Here, we introduce a novel process, incorporating atomic-layer deposition (ALD) and diffusion bonding, for the fabrication of CMUTs with ultrathin membranes. In our fabrication procedure, first a 100 nm Al_2O_3 layer is deposited on an upper silicon wafer by ALD. A 500 nm gold layer is then deposited on the Al_2O_3 layer and patterned to create circular cavities. Then the whole structure is transferred to a bottom wafer by diffusion bonding and the upper silicon wafer is etched away to release the Al_2O_3 membrane. Finally, another 30 nm gold layer is deposited on the membrane for wiring and membrane excitation. Initial results show that extremely flat and uniform membranes can be produced using this process with a RMS roughness of less than 3 Å. The ALD technique also provides more options for membrane material selection and has the potential to improve transducer reliability. In this study, the ALD-fabricated CMUT array is characterized using numerical models. PACS: 43.38.Bs, 43.40.Dx

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