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Effects of Boundary Conditions and Alignment Methods on Liquid Crystal Performance in Microwave Wave Devices

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Microwave devices are ubiquitous in our daily lives; cell phones, satellite communications, automobile safety radars all depend on microwaves. We are working on a technology, a merger of microwave science with liquid crystal physics, that has the potential to revolutionize microwave technology by reducing the size and cost of these devices by a factor of 100. As part of this effort, we are investigating a variety of the techniques used to control the initial state of the liquid crystal in a device to determine the optimum method to use with this emerging microwave technology. From our work, we see that a treated thin film of polyimide provides the best results. However, our work also demonstrates that, if a specialized liquid crystal known as dual frequency liquid crystal is used, the initial state of the liquid crystal does not significantly impact the performance of the device. This discovery reduces the number of steps necessary to manufacture microwave devices, saves on chemical and treatment costs, and eliminates several manufacturing challenges unique to liquid crystal based microwave devices. These benefits add up to a significant savings in time and cost during the design and manufacture of microwave components based on liquid crystal technology.

[1]Harry Lustig Award Session