



Machining of Lithium Niobate by Laser Fracturing

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method for rapidly dicing lithium niobate wafers into a variety of shapes.

Overview

Lithium niobate is used in the fabrication of a wide variety of optical and electro-optic devices, including optical modulators, switches, frequency shifting devices, polarized controllers and pulsed waveguide lasers. This ferroelectric material is also widely used to produce the electronic filters, called SAW filters, that are used in televisions and cell phones.

Currently, lithium niobate wafers are diced into chips by mechanical sawing – a slow and contaminant-laden process. Mechanical sawing also limits the die shapes to rectangles because of the large aspect ratio inherent in dicing blades and wire saws.

The Invention

UW-Madison researchers have developed a method for rapidly dicing lithium niobate wafers into a variety of shapes, including curved shapes. The edges cut with this method are nearly atomically smooth, allowing direct attachment of fiber optic pigtails without further polishing.

The process uses a commercially available laser to create and guide a fracture through the wafer to cut it. Under different beam conditions, the same laser can also ablate features on the wafer surface, such as alignment marks, gratings and microwave and optical cavities. Model calculations have shown that ablated features can significantly improve the performance of devices, such as the traveling wave modulator.

Applications

- Dicing lithium niobate wafers for use in optical and electro-optic devices

Key Benefits

- Provides rapid and controllable shaping and faceting of SAW and optical device lithium niobate dies, significantly reducing manufacturing times
- Results in optically smooth edges for pig-tailing integrated optic devices such as modulators and switches
- Laser-ablated surface features can be used to control the properties of optical and microwave signals in optical and SAW devices.

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