Using lasers to produce an aluminum thin film with controlled crystal orientation

Technology #m02-060

Metallic thin films for electronics are made by depositing aluminum onto a substrate. Often, this aluminum has small microstructures of random orientation, making the film prone to electromigration. Electromigration produces voids along the grain boundaries that, over time, could cause a break in the circuit. This technology overcomes these problems by using sequential lateral solidification (SLS) to produce aluminum thin films with a controlled crystal orientation. The aluminum is completely melted via pulsed laser, and it re-solidifies with crystalline microstructures of increased grain size and more uniform orientation. This technique results in metal thin films of higher quality for use in electronic devices.

Sequential lateral solidification (SLS) increases grain size and results in more uniform orientation of microcrystalline aluminum thin films.

Sequential lateral solidification (SLS) is a powerful tool for producing higher quality thin films. The melting process essentially makes the aluminum a clean slate; therefore, the quality of the film is not dependent on the method used to deposit the aluminum. It is even possible to use this technique without a substrate. The lasers do not require or produce high temperatures, and can be introduced through a mask to control the pattern of the microcrystals. The process can be carried out manually or robotically, introducing the possibility of a more automated production system.

Aluminum thin films treated with the SLS process were characterized by atomic force microscopy (AFM) and electron backscatter diffraction (EBSD).

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Applications:

- Produces metal thin films with crystalline microstructures of a large grain size and uniform orientation.
- Thin films for electronics with reduced electromigration, minimizing the chance of a circuit break.
Advantages:

• Can be carried out at a low temperature.
• Produces rapid crystallization.
• Results in various controllable grain patterns, depending on the masks used.
• Does not require any patterning on the substrate.
• Can be used for aluminum alloys.

Patent information:

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Related Publications:


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