Skysong Innovations
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Method of Providing a Thick Film Polyimide with No Mechanical Means for De-Bonding from Carrier

-Background

Polyimide is used as a substrate for flexible electronics and flexible solar cells. The processing of polyimides has previously been challenging because of their low solubility in common solvents and their high softening temperature. De-bonded polyimide at a thickness of less than 30 microns is difficult to handle without creasing or bending the substrate.

Current techniques have been developed for polyimide processing, including laser ablation through glass carriers to release the polyimide. Methods for mechanical release of the polyimide have been developed but are currently not suitable for thicker polyimide substrate growth. As the polyimide substrate thickness increases, built mechanical stresses can result in a noticeable curl which also renders the polyimide difficult to handle.

Invention Description

Researchers at Arizona State University have developed a novel method of providing a mechanically released, dimensionally stable, and curl-free substrate for flexible electronics fabrication. In this method, polyimide is spin coated onto a carrier wafer (either silicon or glass) and cured at 340°C for one hour in a nitrogen environment. The subsequent layers alternate between molybdenum and another polyimide layer, which is then cured again. A silicon nitride barrier is then deposited on top of the third polyimide layer via plasma enhanced chemical vapor deposition.

After the silicon nitride is deposited, a thin film transistor-based device can be fabricated on the substrate as if it were a silicon or glass wafer. The polyimide substrate and electronic device are delaminated from the carrier glass or silicon substrate mechanically. The de-bonded device can then proceed to driver attach and packaging.

Potential Applications

- 3D packaging (low-cost silicon interposer replacement)
- Flexible displays
- Digital x-ray detectors
- Medical devices

Benefits & Advantages

- Compatible with many geometries and layer structures

- Array lays flat after de-bond (no curl induced)
- De-bonding can occur without mechanical means
- No layer-to-layer delamination
- Does not require laser ablation to de-bond

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