Direct-imagingMetal Interconnection and User Targeted Reliability Techniques for StretchableDisplays and FHE(Flexible Hybrid Electronic) Devices

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A FHE(flexible hybridelectronic) devices are recently recognized as the next generation techniquecombining benefits from both sides such as flexible organic fields and rigid Sibased fields. While the organic based field gives much flexibility with thecharacteristics of low cost production, they also suffer from its inherentlimitations such as low charge transport, process temperature limitation, andetc. Those limitations, based on material itself, make the flexible electronicdevice very difficult to compete with Si-based rigid electronics that haveexcellent device performance. However, the rigidSi based devices are also very weak when they are in use for the flexibleapplications. This is why we thinkthe FHE is the next generation technique. In order toachieve and visualize this new concept, thin device ($\leq$ 50μm) showing highdevice performance was attached on the surface of deformable/flexible polymer substrates to construct flexibleelectronic device circuitsand it is required to interconnect the thin Si based chip on the flexible polymer substrate. For this specific interconnection, weutilized an ElectroHydroDynamic(EHD) micro-patterning system which is not damaging the flexible substrateunlike the conventional wire bonding method that mechanically damages duringthe bonding process. To form narrow Ag based metal interconnections, weoptimized various experimental parameters (flow rate [μl/min], applying voltage [kV], working distance [㎛], jetting velocity and acceleration [mm/s, mm/s^2]) and the metal lines were sintered at 150 ^{o}Cfor 30 mins to remove any solvent contained in thesolution based Ag ink.

In conclusion, we expect our work will providethe platform that can be used in various 3D interconnection situations showinga high device performance with great mechanical flexibility.

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