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3D Integration Platform Development for Neuromorphic Device System

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Abstract

We introduce the recently launched national government granted project about the establishment of 3D vertical stacking process and interconnection fabrication technology for realizing the neuromorphic network and demonstration of the monolithic 3D neuromorphic system. It consists of ① establishment of monolithic 3D process platform, ② development of ultra-fine nano-processing technology, and ③ design and performance verification for neuromorphic system. The monolithic 3D process platform includes 1) development of separation/direct transfer process technology for stacking synapse/neuron device layers, 2) demonstration of low temperature and high precision direct transfer process technology for stacking synapse/neuron device layers, and 3) implementation of 3D stacked neuromorphic device: high-density neuromorphic array structure. The ultra-fine nano processing technology includes 1) development of continuous etching technology for neuromorphic device which etches interconnection via between neuron and synapse uniformly with high aspect ratio and with low damage, 2) ultra-fine patterning for synapse/neuron connection interconnection via formation, and 3) high strength inter-dielectric layer and high conductive metal for neuromorphic system interconnection. The design and performance verification includes 1) development of 3D interconnection electric-thermal modeling and low power inter-connection structure design and 2) development of design infrastructure for M3D neuromorphic system