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Fabrication of Quench Condensed Thin Films Using an Integrated MEMS Fab on a Chip RICHARD LALLY, JEREMY REEVES, THOMAS STARK, LAWRENCE BARRETT, DAVID BISHOP, Boston Univ — Atomic calligraphy is a microelectromechanical systems (MEMS)-based dynamic stencil nanolithography technique. Integrating MEMS devices into a bonded stacked array of three die provides a unique platform for conducting quench condensed thin film mesoscopic experiments. The atomic calligraphy Fab on a Chip process incorporates metal film sources, electrostatic comb driven stencil plate, mass sensor, temperature sensor, and target surface into one multi-die assembly. Three separate die are created using the PolyMUMPs process and are flip-chip bonded together. A die containing joule heated sources must be prepared with metal for evaporation prior to assembly. A backside etch of the middle/central die exposes the moveable stencil plate allowing the flux to pass through the stencil from the source die to the target die. The chip assembly is mounted in a cryogenic system at ultra-high vacuum for depositing extremely thin films down to single layers of atoms across targeted electrodes. Experiments such as the effect of thin film alloys or added impurities on their superconductivity can be measured in situ with this process.

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