Microelectromechanical systems (MEMS) are increasingly used in sensor and actuator applications. Many MEMS fabrication techniques were well-established. Among those, one of the widely used methods is electroplating process. Although the electroplating method has been used mainly for surface finishing traditionally, the same method in combination with photolithography is used for making structural or sensing components in MEMS. In this thesis topic, the study focuses on the design and fabrication of micro- and nanoscale features for electrospray emitters and environmental sensors.

In-plane metallic electrospray devices with an embedded array of microposts within a microchanel were designed and fabricated to achieve an even electro-hydrodynamic pulling force and demonstrate a flexing capability of electrospray. The novelty of the proposed research lies in its embedded flow restriction structure, scalability, and ease of fabrication. Utilizing a pulsed electroplating method, Co-Cu metal alloy films were prepared and Cu was selectively etched to fabricate nanoporous electrodes which could be used to measure both absolute levels and changes of phosphate in aqueous environments. The formation of cobalt phosphate compound could be used for the detection. The increased surface area and relatively simple fabrication protocols make the proposed method attractive and promising for many environmental sensing applications.